HAMEG Instruments

Spectrum analyzer HM5011 HM5010

ENGLISH

4S-5010-0010

09 JUN 1998

SERVICE-MANUAL HM5011/5010

Service Manual
Adjustment Procedure
Circuit Diagrams
HM5010/5011

Specifications

Frequency

Frequency range: 0.15MHz to 1050MHz (-3dB)
Center frequency display accuracy: ±100kHz
Marker accuracy: ±(0.1% span + 100kHz)
Frequency display res.: 100kHz (4½ digit LED)
Frequency scanwidth: 100kHz/div. to 100MHz/div. in 1-2-5 steps and 0Hz/div. (Zero Scan)
Frequency scanwidth accuracy: ±10%
Frequency stability: better than 150kHz / hour
IF Bandwidth (-3dB): Resolution: 400kHz and 20kHz; Video-Filter on: 4kHz
Sweep rate: 43Hz

Amplitude

Amplitude range: -100dBm to +13dBm
Screen display range: 80dB (10dB / div.)
Reference level: -27dBm to +13dBm (in 10dB steps)
Reference level accuracy: ±2dB
Average noise level: -99dBm (20kHz BW)
Distortion: <-75dBc; 2nd and 3rd harmonic
3rd order intermod.: -70dBc
(two signals >3MHz apart)
Sensitivity: <5dB above average noise level
Log scale fidelity: ±2dB (without attn.) Ref.: 250MHz
IF gain: 10dB adjustment range

Input

Input impedance: 50Ω
Input connector: BNC
Input attenuator: 0 to 40 dB (4 x 10dB steps)
Input attenuator accuracy: ±1dB/10dB step
Max. input level: +10dBm, ±25V_{DC} (0dB attenuation)
+20dBm (40dB attenuation)

Tracking Generator

Output level range: -50dBm to +1dBm (in 10dB steps and var.)
Output attenuator: 0 to 40dB (4 x 10dB steps)
Output attenuator accuracy: ±1dB
Output impedance: 50Ω (BNC)
Frequency range: 0.15MHz to 1050MHz
Frequency response: ±1.5dB
Radio Frequency Interference (RFI): <20dBc

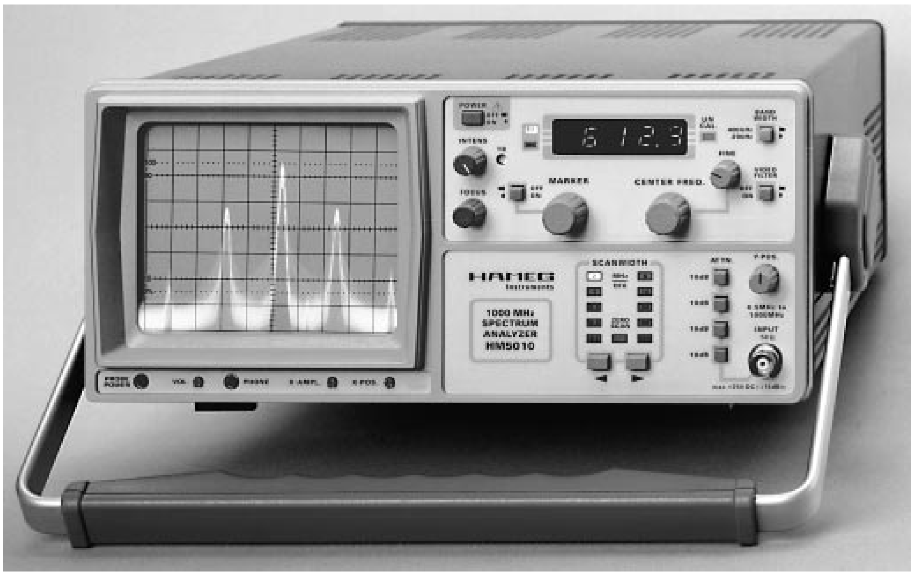
Divers

AM-Demodulator output for head-sets.
Permissible load impedance >8Ω

General

Display: CRT. 6 inch, 8 x 10 div. intern. graticule
Trace rotation: Adjustable on front panel
Line voltage: 115 / 230V ±10%, 50-60Hz
Power consumption: approx. 20W
Operating ambient temperature: 0°C..+40°C
Protective system: Safety Class I (IEC 1010-1)
Weight: approx. 7kg
Cabinet: W 285, H 125, D 380 mm

Subject to change without notice 5/96



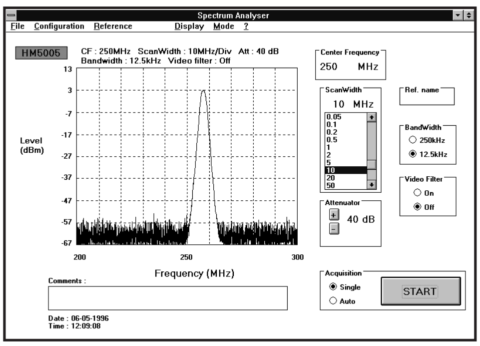
Spectrum Analyzer HM5010 / HM5011

Frequency Range 0.15MHz - 1050MHz.
4½ Digit Display (Center & Marker Frequency, 0.1MHz resolution)
–100 to +13dBm Amplitude Range, 20kHz, 400kHz and Video-Filter
Tracking-Generator (HM5011 only):
Frequency range: 0.15MHz - 1050MHz.
Output Voltage: +1dBm to –50dBm (50Ω).

Evolution of the original HM5005/HM5006 has led to the **new HM5010/ HM5011 Spectrum Analyzer/Tracking Generator** which now extends operation **over 1 GHz** (frequency range 0.15 to 1050 MHz). Both fine and coarse center frequency controls, combined with a scanwidth selector provide simple frequency domain measurements from 100 kHz/div. to 100 MHz/Div.. Both models include a **4½digit** numeric **LED readout** that can selectively display either the center or marker frequency. The **HM5011** includes a **tracking generator**.

The **HM5010/5011** offer the same operation modes as the HM5005/5006. The instruments are suitable for pre-compliance testing during development prior to third party testing. A near-field sniffer probe set, **HZ530**, can be used to locate cable and PC board emission "hot spots" and evaluate **EMC problems** at the breadboard and prototype level. The combination of **HM5010 / 5011** with the **HZ530** is an excellent solution for RF leakage/radiation detection, **CATV/ MATV** system troubleshooting, cellular telephone/pocket pager test and **EMC** diagnostics. There is an optional measurement output for a PC which makes documentation of results easy and affordable with the **HO500 Interface**.

Accessories supplied: Line Cord, Operators Manual. Optional accessories, 50Ω-feedthrough termination HZ22 Viewing Hood HZ47, Near Field Probe Set HZ530, Carrying Case HZ96-2, Transient Limiter HZ560



HO500 Computer Interface for HAMEG Spectrum Analyzer

This **HO500** computer interface offers the facility to transfer a calibrated frequency spectrum from any **HAMEG spectrum analyzer** to a PC. The **HO500 interface** is a 8 bit **ISA BUS card** installed in the **PC**, which transfers data via an interface cable. The software supplied allows a hard copy print out (including parameters) of the frequency spectrum, in **Windows Format**. Signal aquisition occurs **2 to 3** times **per second**.
The picture consists of 10 bit vertical by approx 3600 point horizontal display. The PC monitor display is in **SVGA** Format with 800 x 600 pixels. For comparison measurements, a previously stored reference curve can be recalled. The software supplied works under Windows 3.1, 3.11 and WIN95. A simple XY analog output is required to connect the **HO500** to the spectrum analyzer.

Specifications

Frequency

Frequency range: 0.1MHz to 1000MHz (lower frequency limit depends on probe type)
Output impedance: 50 Ω
Output connector: BNC-jack
Input capacitance: 2pF (high imped. probe)
Max. Input Level: +10dBm (without destruction)
1dB-compression point: -2dBm (frequency range dependent)
DC-input voltage: 20V max.
Supply Voltage: 6V DC
4 AA size batteries
Supply-power of HM5010/5011

Supply Current: 8mA (H-Field Probe)
15mA (E-FieldProbe)
24mA(High imp.Probe)
Probe Dimensions: 40x19x195mm (WxDxL)
Housing: Plastic; (electrically shielded internally)

Package contents: Carrying case
1 H-Field Probe
1 E-Field Probe
1 High Impedance Probe
1 BNC cable (1.5m)
1 Power Supply Cable

(Batteries or Ni-Cads are not included)



Near Field Sniffer Probes HZ 530

The HZ530 is the ideal toolkit for the investigation of **RF electromagnetic fields**. It is indispensable for **EMI pre-compliance testing** during product development, **prior to third party** testing. The set **includes 3 hand-held probes** with a built-in pre-amplifier covering the frequency range from **100kHz** to over **1000 MHz**.

The probes - one **magnetic field** probe, one **electric field** probe, and one **high impedance** probe - are all matched to the 50Ω inputs of **spectrum analyzers or RF-receivers**. The power can be supplied either from batteries, Ni-Cads or through a power cord directly connected to an HM5010/HM5011 series spectrum analyzer.

Signal feed is via a 1.5m BNC-cable. When used in conjuction with a spectrum analyzer or a measuring receiver, the probes can be used to locate and **qualify EMI sources**, as well as evaluate EMC problems at the **breadboard** and **prototype level**. They enable the user to evaluate radiated fields and perform **shield effectiveness comparisons**. Mechanical screening performance and immunity tests on cables and components are easily performed.

The H-Field Near-Field Probe

The H-Field probe provides a voltage to the connected measurement system which is proportional to the magnetic radio frequency (RF) field strength existing at the probe location. With this probe, circuit RF sources may be localized in close proximity of each other. The H-field will decrease as the cube of the distance from the source. A doubling of the distance will reduce the H-field by a factor of eight ($H = 1/d^3$); where d is the distance.

In the actual use of the H-field sensor one observes therefore a rapid increase of the probe's output voltage as the interference source is approached. While investigating a circuit board, the sources are immediately obvious. It is easily noticed which component (i.e. IC) causes interference and which does not. In addition, by use of a spectrum analyzer, the maximum amplitude as a function of frequency is easily identified. Therefore, one can eliminate early in the development components which are not suitable for EMC purposes. The effectiveness of countermeasures can be judged easily. One can investigate shields for "leaking" areas and cables or wires for conducted interference.

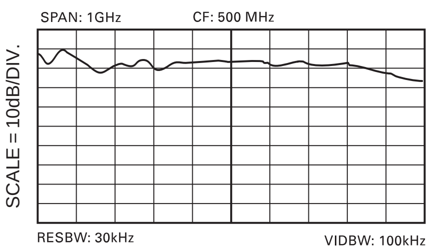
The High-Impedance Probe

The high-impedance probe (Hi-Z) permits the determination of the radio frequency interference (RFI) on individual contacts or printed circuit traces. It is a direct-contact probe. The probe is of very high impedance (near the insulation resistance of the printed circuit material) and is loading the test point with only 2 pF (80Ω at 1 GHz). Thereby one can measure directly in a circuit without significantly influencing the relationships in the circuit with the probe.

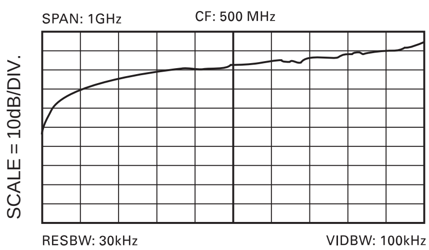
One can, for example, measure the quantitative effectiveness of filters or other blocking measures. Individual pins of ICs can be identified as RFI sources. On printed circuit boards, individual problem tracks can be identified. With this Hi-Z probe individual test points of a circuit can be connected to the 50Ω impedance of a spectrum analyzer.

The E-Field Monopole Probe

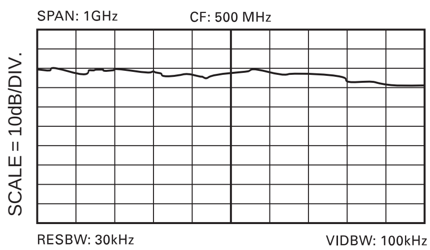
The E-field monopole probe has the highest sensitivity of the three probes. It is sensitive enough to be used as an antenna for radio or TV reception. With this probe the entire radiation from a circuit or an equipment can be measured. It is used, to determine the effectiveness of shielding measures. With this probe, the entire effectiveness of filters can be measured by measuring the RFI which is conducted along cables that leave the equipment and may influence the total radiation. In addition, the E-field probe may be used to perform relative measurements for certification tests. This makes it possible to apply remedial suppresion measures so that any re-qualification results will be positive. In addition, pre-testing for certification tests may be performed so that no surprises are encountered during the certification tests.



Frequency Response E-Field Probe (typical)



Frequency Response H-Field Probe (typical)



Frequency Response High Impedance Probe (typical)

Alignment Procedure for HM5010/HM 5011

Attention! The opening of covers or removal of parts is likely to expose live parts and accessible terminals which can be dangerous to life. Maintenance, service and alignment should be carried out by qualified personnel only, which is acquainted with the danger involved.

When aligning the HM5010/5011 it is assumed that all sub-assemblies of the instrument are completely pretested and working correctly. The tuner, IF-unit, and tracking generator should be pre-aligned. When aligning a HM5010, a separate tracking generator unit must be available and connected to the HM5010 for some specific adjustments.
Prior to the alignment procedure, the instrument must warm up for 60 minutes.
All adjustments are carried out by means of a plastic screw driver or a ceramic adjustment tool.

The alignment is divided into the following steps:

A Checking of supply voltages
B Alignment of the tuner
C Alignment of the IF-unit
D Linearity alignment
E Tracking generator alignment
F Check of overall adjustment

The numbering system is related to the respective pictures. Screen shots are designated as PIC
1 HF-Synthesizer 100 kHz to 1000 MHz, i.e. HM 8133
2 BNC cable, BNC T-connector, 2 x 10dB attenuator 50 Ohm
1 Voltmeter i.e. HM 8011-3

A Control and Adjustment of Supply Voltages

adjust: 12V to an accuracy of ±0.1V via **Trimpot 4 PIC 1**
adjust: minimum brightness via **Trimpot 2 PIC 1**
adjust: maximum brightness via **Trimpot 3 PIC 1**
adjust: astigmatism via **Trimpot 1 PIC 1**

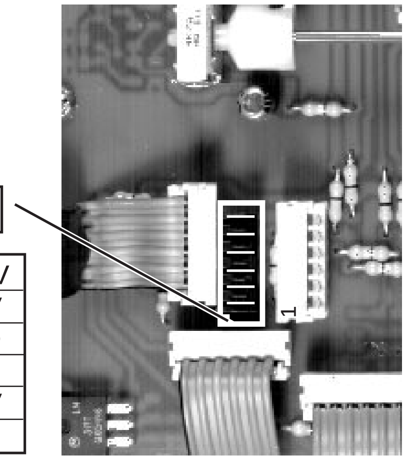
check: –12V tolerance ± 0.2V
check: +12V tolerance ± 0.1V
check: +5V tolerance ± 0.2V
check: –5V tolerance ± 0.2V
check: +38V tolerance ± 1V
check: +138V tolerance ± 1V

The corresponding voltage test points to check direct voltage can be measured at the measuring connector strip (see PIC 2).

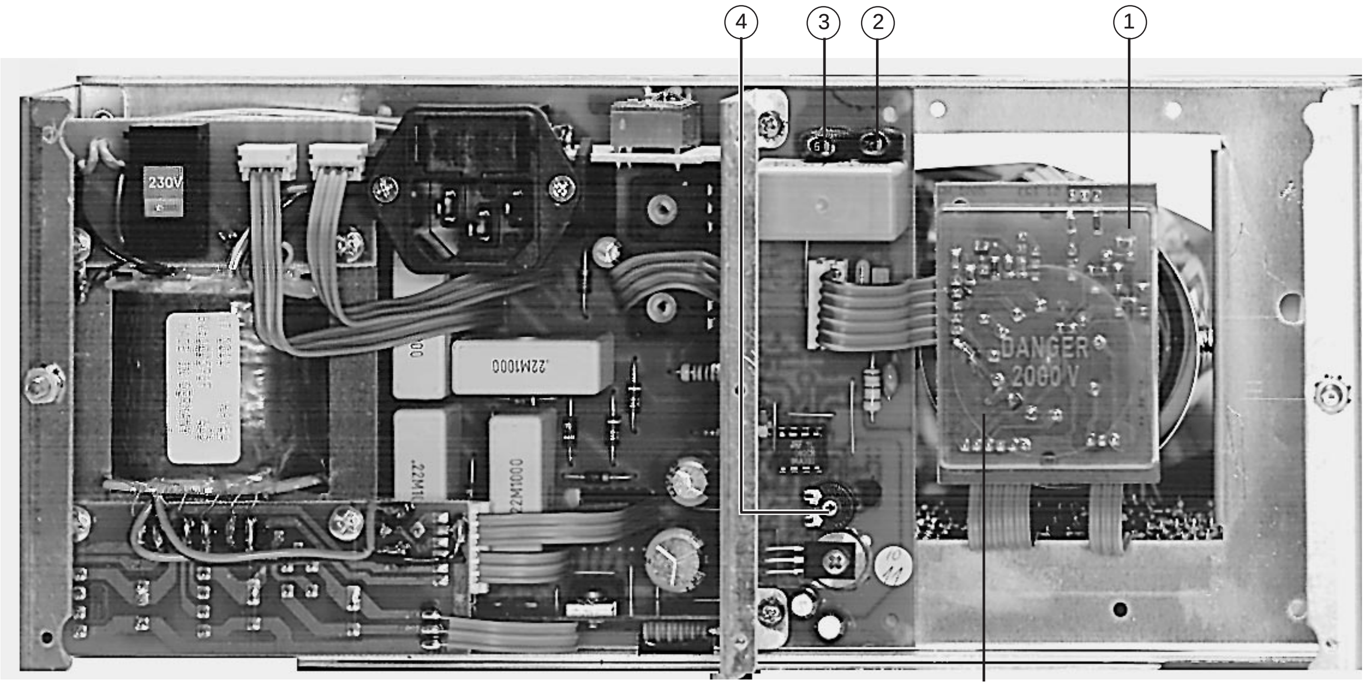
Basic adjustment:
When Y-pos. knob is snapped in on front board, adjust beam approx. 2 mm below bottom graticule line via R801.



1	+138V
2	+38V
3	GND
4	+5V
5	+12V
6	-12V



PIC 2. XYF-Board (partial)



PIC 1. PS-Board **Instrument Rear Side** **CRT-Board**

B Final Adjustment - Tuner

The tuner is already aligned by the factory. When changing the 1st mixer, it might be necessary to realign cavity filter: Set signal to 500MHz -27dBm to input, center frequency to 500MHz, Scanwidth to 0.5MHz, turn all three M3 screws to max. amplitude. In case curve is not uniform, coils L1, L2, and L3 can be adjusted to maximum uniformity (fig. 22) by slightly bending them.

In case signal in frequency range is shacky, 2nd local oscillator might not be snapped in correctly. The correct snap-in of the PLL is visible via the lock detect LED (D2), which has to be lit constantly without flickering if PLL is snapped-in correctly.
The oscillator signal has to be fixed (crystal dependent) at 1.32GHz, it may not drift.
The PLL is snapped-in when the tuning voltage VT (measure at PAD1) is between 0.5 and 4.5V. The alignment will bring the tuning voltage to the center of the tuning range. VT of the 2nd LO has to be between 2V and 2.5V. Constantly check tuning voltage while aligning tuner.

Alignment is necessary in two cases: VT<2.0V and VT>2.5V.

• *Case 1 VT<2.0V*
Correction:
a) Solder all adjustment areas to connect trace from C1 to C2.
b) Remove excess solder at center conductor of resonator pad.

• *Case 2 VT>2.5V*
Correction:
a) Adjustment areas may not be soldered to connect trace from C1 to C2.
b) Add solder to resonator pad.

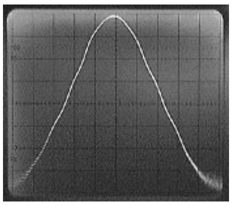


fig. 22 for HM5010

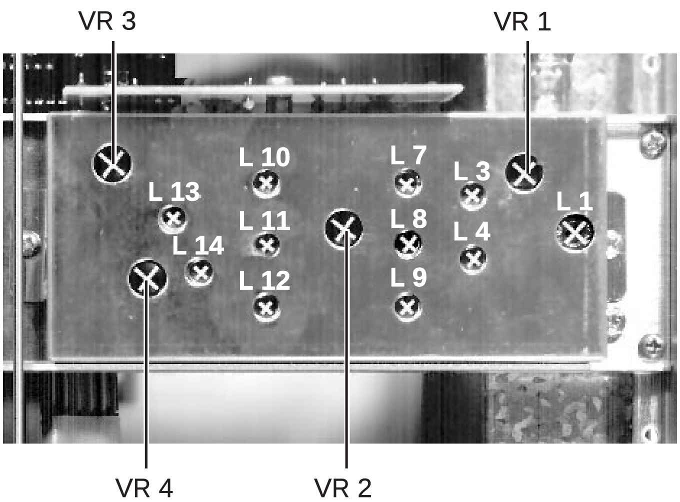
C Alignment of IF-Unit

Measurement setup: Apply two different signals to the input of the HM5011 via BNC T-connector and 10dB attenuators.
Adjust HM5010/5011: Center frequency to 500MHz; all attenuators on (–40 dB) Bandwidth 400kHz; video filter off; scanwidth 0.5MHz/div.; marker off.
Adjust Tracking Generator: Attenuator –20dB; level max. (HM5011 only)
RF-generator: frequency 500MHz; level –5dBm

The output voltage of the tracking generator is visible on the screen by an overlay of the fixed frequency. A "zero" point is visible within the signal to the right or to the left of the 500MHz spectral line (**fig. 23**) (5011 only).

IF Filter Curve at 400kHz Bandwidth

align:	Step 1	Align (with plastic screw driver) **Coil L1 (PIC 5)** to maximum output amplitude and symmetry to Y-axis.
align:	Step 2	Align (with plastic screw driver) **Coils 3 + 4 + 13 + 14 (PIC 5)** to symmetrie to Y-axis. The "zero" point must be at the maximum (at 500MHz) (**fig. 23**).
align:	Stept 3	If necessary, repeat step 1 and 2.



PIC 5 IF-Amp Board

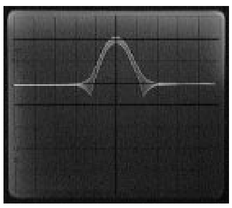


fig. 23 for HM5011

IF Filter Curve at 20kHz Bandwidth (HM5010)

align: Step 1 Align (with plastic screw driver) **Coils L7+8+9+10+11+12** until "zero" point is exactly centered at 500MHz (as with 400kHz Bandwidth).
Watch for symmetry of Filter Curve.

IF Filter Curve at 20kHz Bandwidth (HM5011)

Pre-Alignment: Remove T-connector. Connect tracking generator module directly to the input of the HM5011. Turn off attenuators on tracking generator module and on HM5011 (0 dB). The output voltage of the tracking generator module is now visible as horizontal line (with slight ripple).

adjust*:* Step 1 Adjust (with plastic screw driver) **Coils 7 + 8 + 9 + 10 + 11 + 12** to maximum screen height of displayed output voltage. Add attenuators of HM5010/5011 as soon as "line" has reached the middle of the screen (–30 dB).

adjust: Step 2 This alignment has to be performed repeatedly in order to optimize settings.

Fine Alignment: Connect BNC-T-connector again as in the beginning of the IF alignment. Set attenuator of tracking generator module to –20dB, scanwidth to 0.5 MHz/div. If necessary, re-adjust center frequency (adjust 500MHz spectral line to screen center). "Zero" point is now visible to the right or to the left of screen center (amplitude maximum) (**fig. 24**).

adjust: Step 1 Align (with plastic screw driver) **Coils L7+8+9+10+11+12** until "zero" point reaches maximum. Watch for symmetry of Filter Curve.

adjust: Step 2 This alignment has to be performed repeatedly in order to optimize settings.

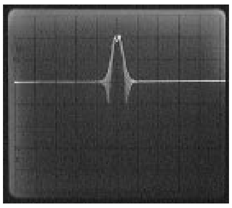


fig. 24

IF Gain - Adjustment of different Bandwidths

Set scanwidth to 0.2MHz/div. Switch bandwidth repeatedly between 400kHz and 20kHz. The distance between the output voltage (line) of the tracking generator and tge 400MHz amplitude may not vary. If the amplitude values do not match exactly, adjust by means of R-trimmer **VR2 (PIC5)**.

Linearity of IF-Amplifier Gain

The linearity of the IF-amplifier gain has to be checked through the entire display range. Apply a 400MHz (-27dBm) signal directly to the input of the HM5010/5011. Adjust scanwidth to 5MHz/div, release attenuator switched (0 dB), select filter bandwidth of 400kHz. The spectral line should reach the upper screen edge. Use attenuators to reduce signal in 10db steps, whereby each individual attenuation step has to reduce the level by 10dB ±1dB. In case deviation is as follows:

- A the drop of the individual attenuation steps is larger than 10dB ± 1dB, or

- B the drop of the individual attenuation steps is smaller than 10dB ±1dB, the linearity of the attenuators has to be adjusted as follows:

  Set attenuator to -40dB. Adjust spectral line exactly to -40dB (center line) via **VR1, VR3, VR4**. Then set attenuators back to 0dB und adjust spectral line by means of trimpots VR802A and VR801 (XY board) to zero point and base line to bottom graticule line. This procedure has to be repeated until the settings at -40dB and 0dB are correct.

D Linearity of Frequency Display

Settings for HM5010/5011: Center frequency at 500MHz; all attenuator switches released; filter bandwidth 400kHz; video filter off; scanwidth to 100MHz/div.; marker off.

Measurement Setup: Apply signal of 500MHz –27dBm to input of HM 5010/5011.

Check: Basic setting: The HM5010/5011 has to be adjusted that the noise level touches the bottom graticule line. The spectral line of 500MHz -27dBm reaches the top graticule line and is situated in the center of the screen. Adjust 500MHz spectral line exactly to screen center via X-pos knob (on front of the unit).

Check: Upper frequency limit: Check if frequency of minimum 1050 can be set as center frequency.

Adjust HM5010/5011 to basic setting (see above). Apply input signal of 100MHz, level +7dBm Overriding the input allows for the harmonics of the input signal to become visible (**fig. 7**). This simplifies the adjustment of individual spectral lines in horizontal direction.

adjust: Spectral line at 400MHz
Turn X-ampl. knob on front of instrument to have the 4 spectral lines matched with the corresponding graticule lines on the screen(**fig. 8**).

adjust: Spectral line at 100MHz
With Trimpot **RV171** align to match this spectral line with the corresponding graticule line on the screen (**fig. 9**).

adjust: Zero Peak
With Trimpot **RV173** align to match this spectral line with the corresponding graticule line on the screen (**fig. 9**).

adjust: Spectral line at 600-1000MHz
With Trimpot **RV186** adjust to match 700MHz to the correct graticule line.

adjust: Spectral line at 800 MHz;
With Trimpots **RV181 + RV183 for 900MHz and RV197 for 1000MHz (PIC 3)** adjust to match this spectral line with the corresponding graticule line on the screen.

adjust: Beam length
With Trimpot **RV101** adjust beam to end approx. 1mm beyond the right CRT boundary (graticule) (**Fig. 11** - base line too short)
(**Fig. 10** - 300 to 1000MHz spectral lines not correct)

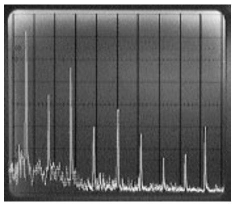


fig. 7

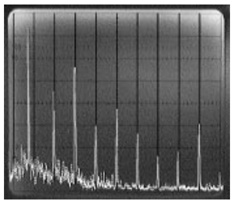


fig. 8

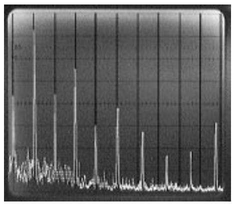


fig. 9

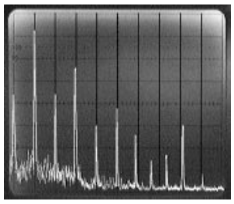


fig. 10

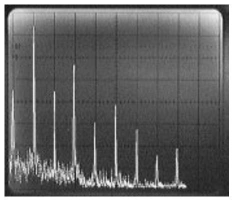
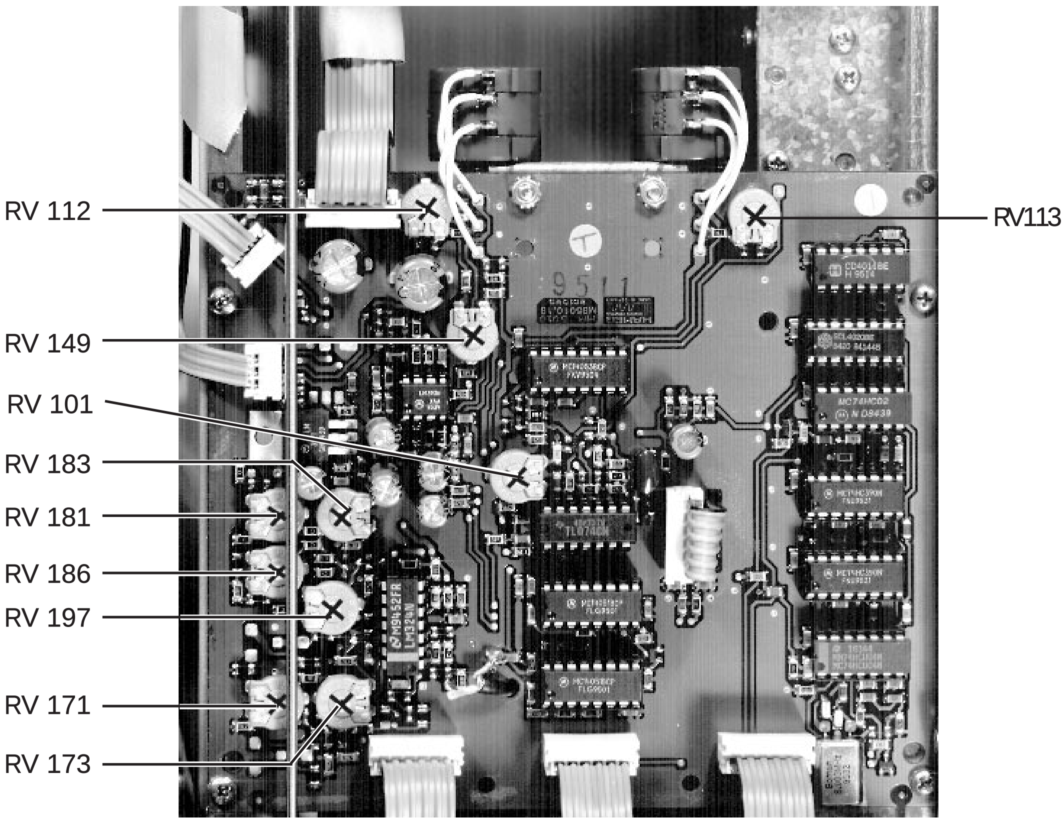


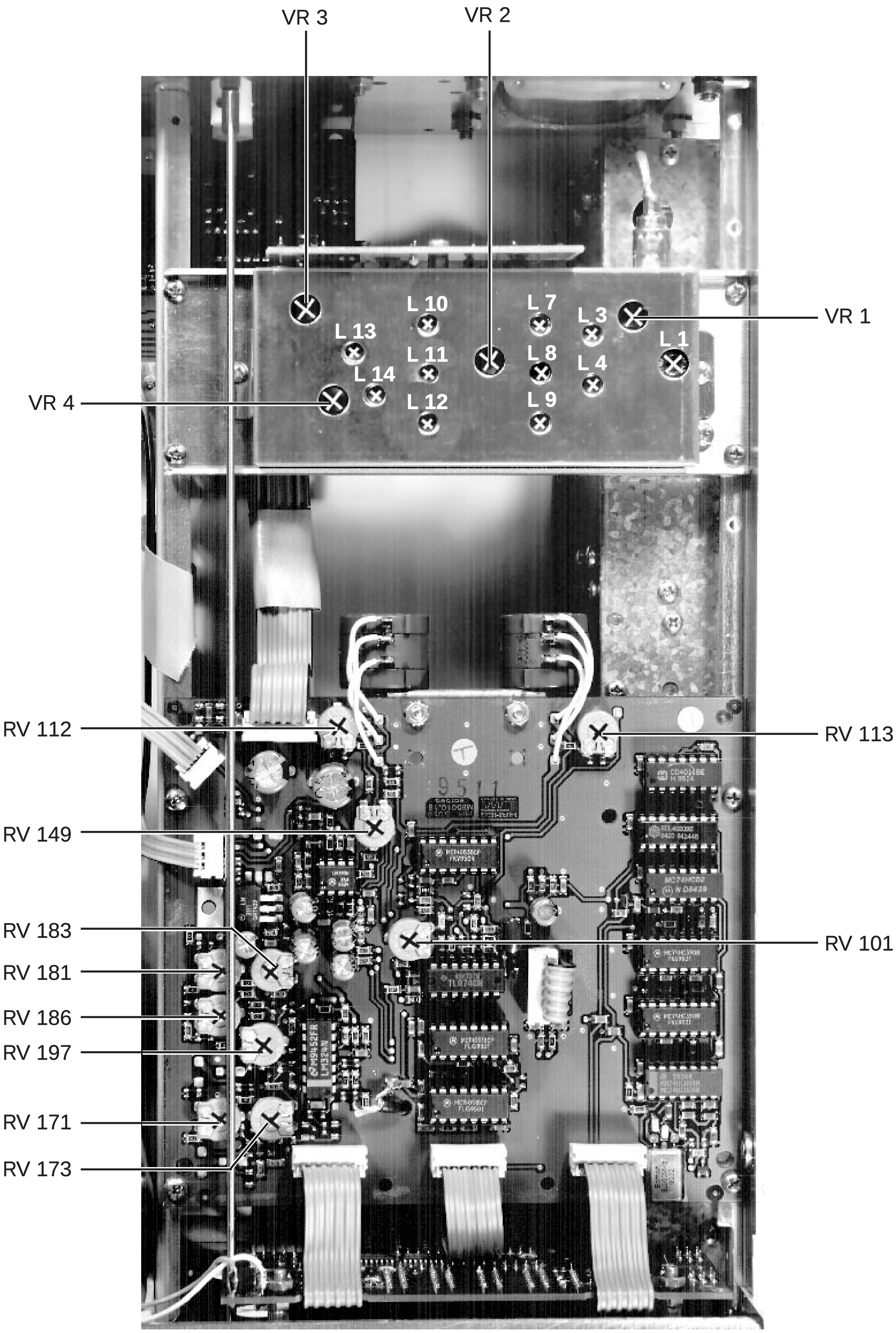
fig. 11



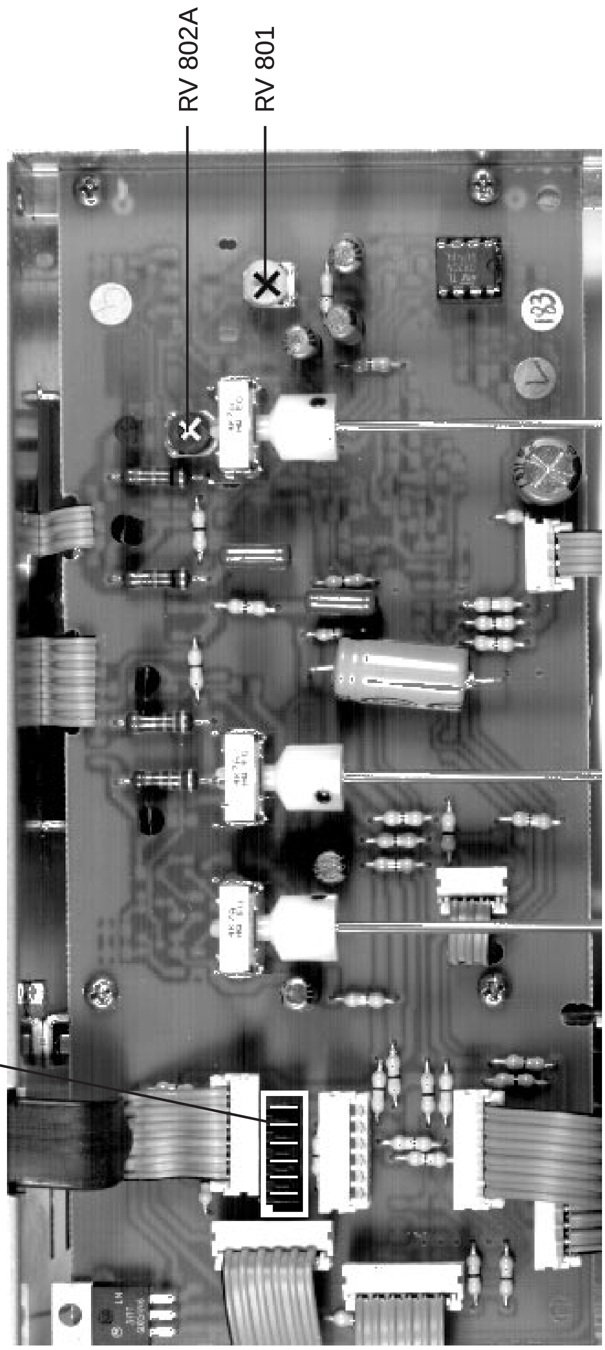
PIC 3 - MB-Board

Set **Trimpot RV113** that frequency will not display below 990MHz when center frequency is set to lowest frequency

Adjust Marker.
Settings on HM5010/5011: Center frequency to 500MHz, all attenuators in off position, filter bandwidth to 400kHz, video filter off.
Scanwidth to 100MHz, Marker on.
Signal 100MHz +7dBm.
Adjust Marker to 500MHz display and set to 500MHz mark on screen via RV149 (PIC 4).
Turn Marker left to max. and adjust to 990MHz via RV112.

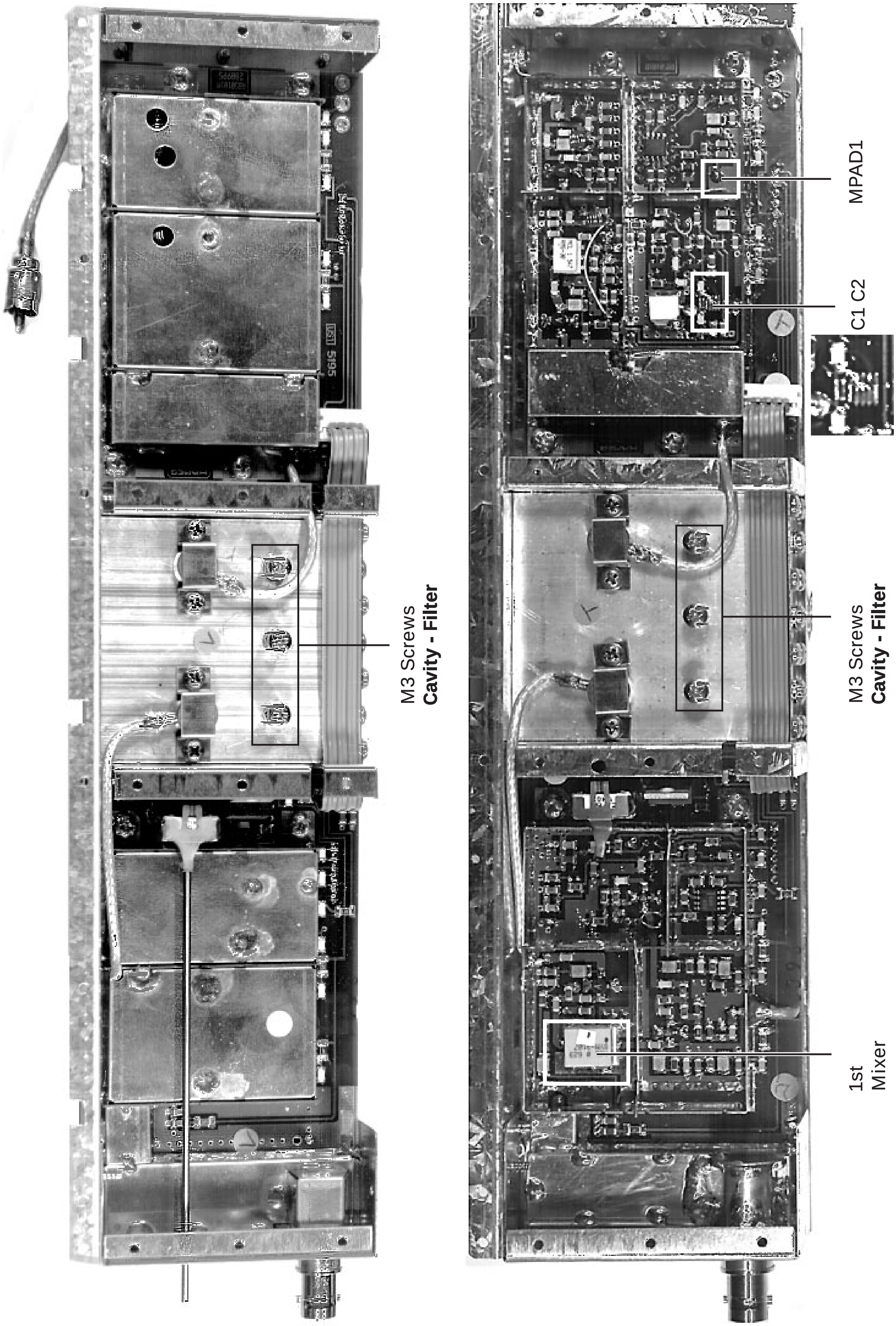


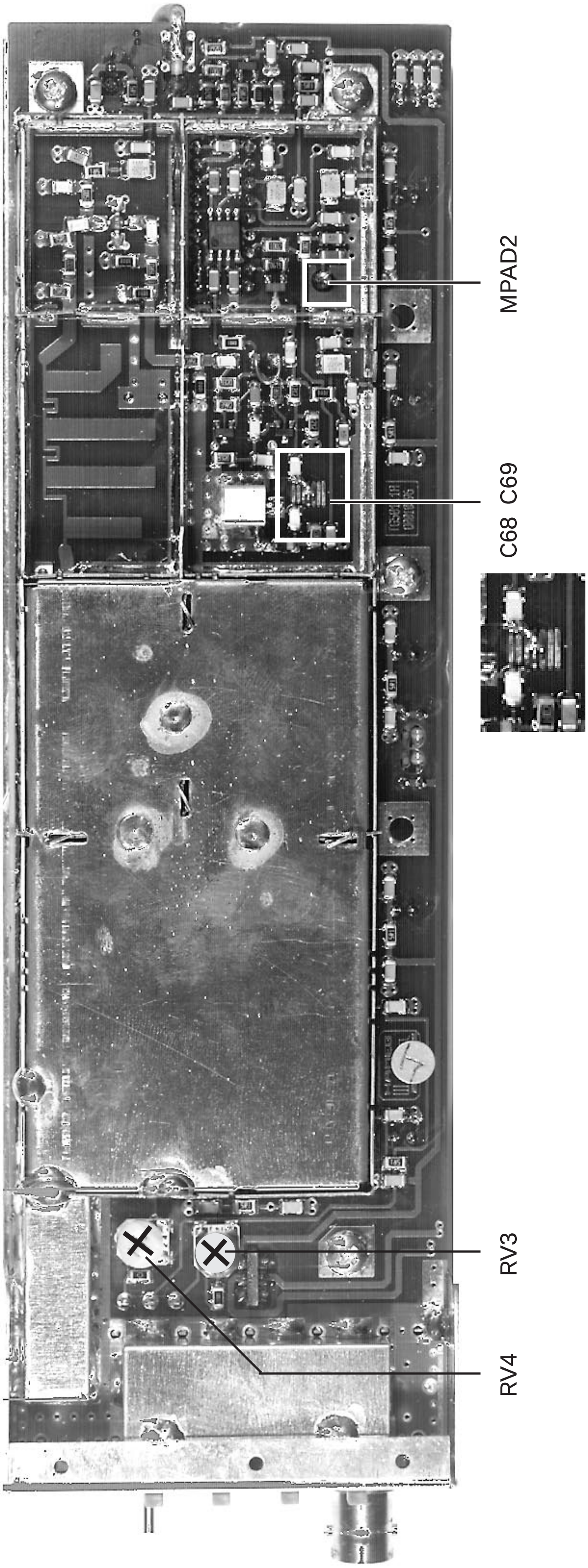
PIC 3 - Main-Board





1	+138V
2	+38V
3	GND
4	+5V
5	+12V
6	-12V


M3 Screws
Cavity - Filter
MPAD1
C1 C2
M3 Screws
Cavity - Filter
1st
Mixer


MPAD2
C68 C69
RV3
RV4

E Alignment of HM5011 Tracking Generator

1. Required Instruments:

1.1 Spectrum Analyzer - minimum 1000MHz
1.2 Completely assembled HM5011
1.3 Multimeter to measure DC voltage
1.4 Oscilloscope, i.e. HM303
1.5 Coax cabel

2. Preparation:

2.1 Assemble Spectrum Analyzer completely (without case).
2.2 All sub-assemblies have to be pre-checked.
2.3 HM5011 has to be warmed up.
2.4 Connect VCO output of RA board to VCO input (MCX connector).
2.5 Connect 12MHz reference clock of TG board to RCA connector ST1 on RB board.

3. Check Signalling Lines

Cable connection W1

Pin Nr.	Description	Signal
1	-12V	Supply OP
2	+12V	Supply
3	+5V	Supply PLL

4. Check Supply and Bias Voltages

Comp.Nr.	Pin Nr.	Description	Voltage
C1	1	1. VCO Amp.	+5.8 V
C2	1	2. VCO Amp.	+5.8 V
C11	3	fix LO Amp.	+5.9 V
C6	5	Var. Amp.	+5.6 V
C9	3	1. Power Amp.	+3.6 V
C12	3	2. Power Amp.	+4.8 V

5. Alignment of fixed LO

5.1 The 2nd LO oscillates at a frequency of 1.35 GHz. The level at the mixer input IC3 Pin2 is -17dBm. Oscillation of the 2nd LO can also be measured with the H or E-Field Probe (HZ530).

5.2 Lock-Detect LED (D4) will confirm the correct PLL lock when lighting up without flickering or going out.
The oscillator signal has to remain fixed crystal dependent) at 1.35GHz and may not drift. PLL is locked if tuning voltage VT (measure at PAD2) is between 0.5 and 4.5V. Align tuning voltage to medium tuning range. VT of fixed LO should be between 2 and 2.5V. The tuning volage has to be check constantly during alignment.
Place coax resonator CR2 bottom side to the edge of soldermask next to center conductor, and solder on the left and the right side.

5.3 Alignment is necessary in two cases: VT<2.0V and VT>2.5V.

• *Case 1 VT<2.0V*
Correction:
a) Solder all adjustment areas to connect trace from C1 to C2.
b) Remove excess solder at center conductor of resonator pad.

• *Case 2 VT>2.5V*
Correction:
a) Adjustment areas may not be soldered to connect trace from C1 to C2.
b) Add solder to resonator pad.

6. Control of fixed LO-Level

6.1 To check 2nd LO-level, cap C20 (22pF) has to be removed and 50Ohm Coax-cable has to be connected to -13dB attenuator of output. Connect other end of coax cable with adequate test analyzer.
6.2 Adjust test analyzer to 1.35 GHz center frequency; the LO-level to be measured has to be -17dBm (±1 dB) (consider attenuation of cable).
6.3 If cap is not removed and coax cable is connected parallel to mixer to the VCO-branch, a level of approx. -24 dBm (±1dB) should be measured due to decreased load resistance.

7. Check of VCO

7.1 Adjust HM5011 to Zero Scan, center frequency to 500MHz.
7.2 Remove Cap C14 (22pF), connect one side to attenuator output, other side stand up in the air.
7.3 Connect Cap side sticking up in the air to center conductor of 50 Ohm cable. Solder shielding of cable directly next to Cap to ground. Connect other end of Cap to Analyzer input (i.e. Advantest R3361A). Start 1.35GHz - Stop 2.35GHz reference level: 0dBm.
7.4 VCO signal which can be observed on the test analyzer has to shift according to center frequency (tuning voltage). Tuning range has to be at least from 1350 to 2350 Mhz. continuously and without interruption. It should not go under absolute level of +7dBm (coax cable of 1 mtr. has 1-2 dB of attenuation at 2GHz). Level has to be between +7 dBm and +10 dBm.
7.5 Connect coax cable parallel to 1st mixer to VCO-branch. A level of +5 dBm to +8 dBm due to decreased load resistance over frequency band.

8. Check of Attenuators:

8.1 Set -30dB attenuation to Tuner and to 0dB attenuation to TG.
8.2 Set Center Frequency to 500MHz, 100MHz/Div. span.
8.3 Connect tracking generator to tuner input.
8.4 TG-line has to be visible.
8.5 Switch on additional attenuators. Attenuation for each attenuator switch has to be 10dB (±1 dB)

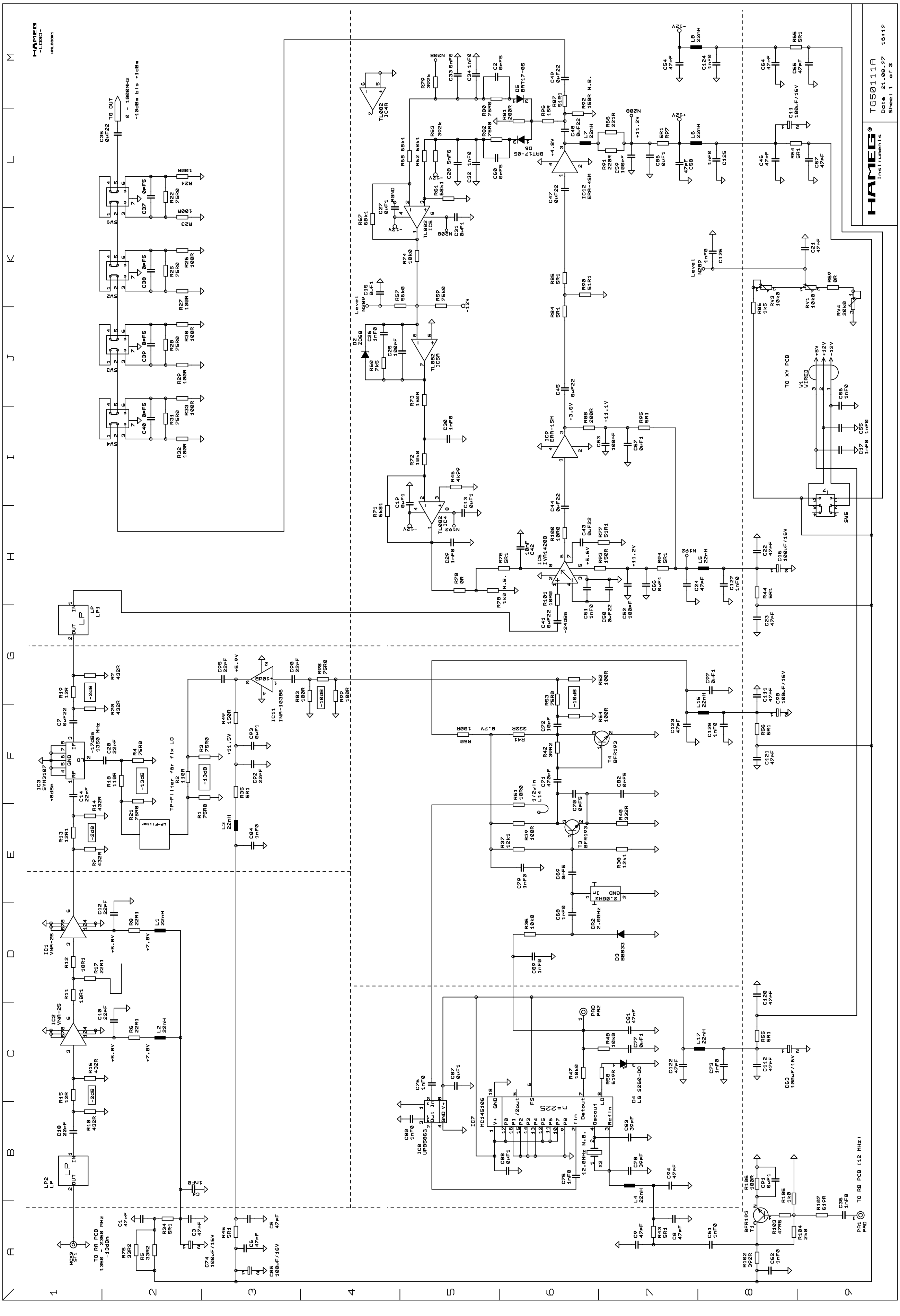
9. TG Level Adjustment:

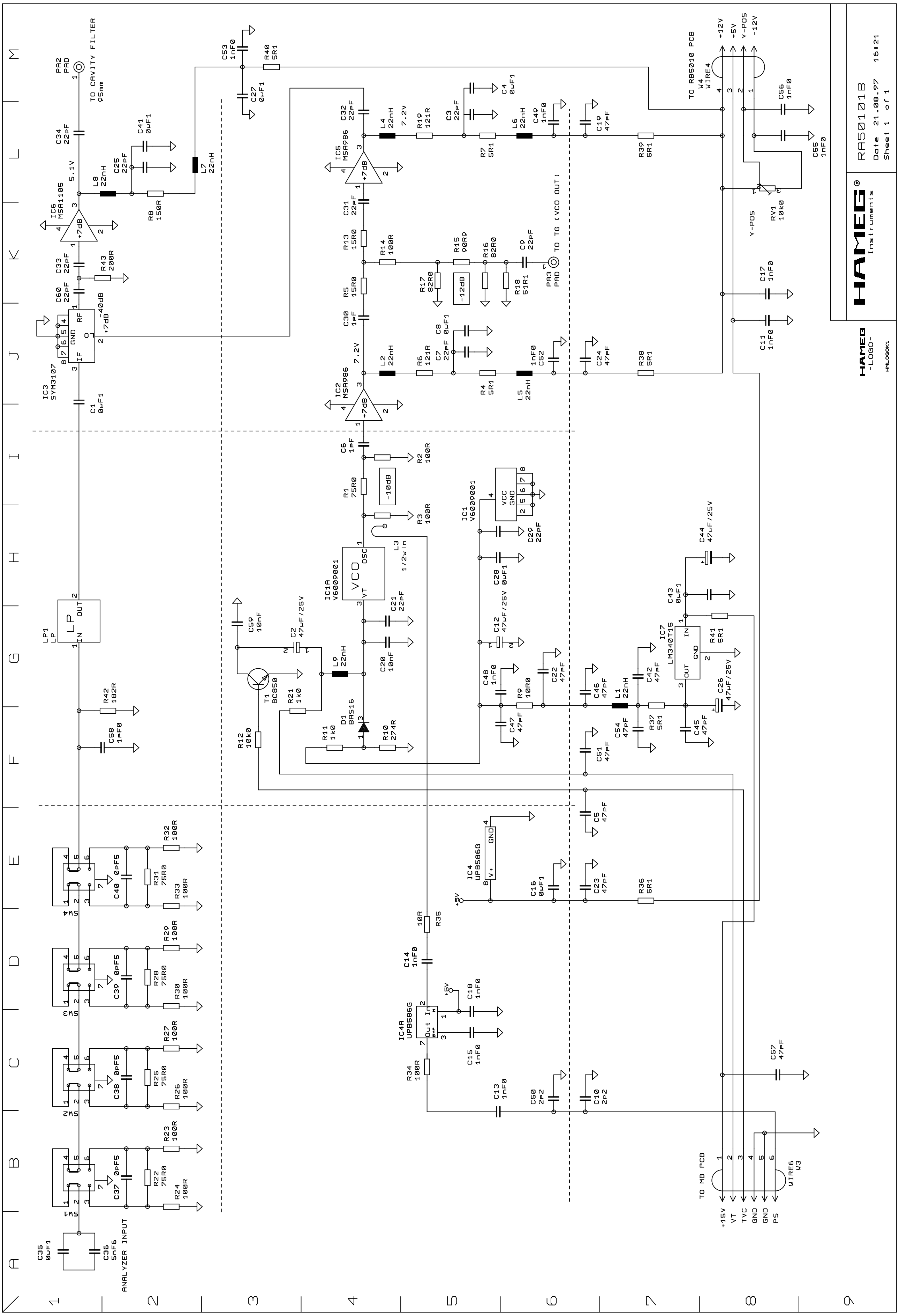
9.1 Connect TG to reference analyzer.
9.2 Set HM5011 to Zero Scan and 500MHz Center Frequency.
9.3 Release all attenuator buttons of TG (0-dBm) and turn TG-level to maximum.
9.4 Adjust amplitude to +1dBm with Pot RV4 on TG.
9.5 turn TG-level to minimum.
9.6 Adjust amplitude to -10dBm with Pot RV3 on TG.
9.7 Amplitude has to be adjustable now between +1dB and -10dB.

10. Final Check

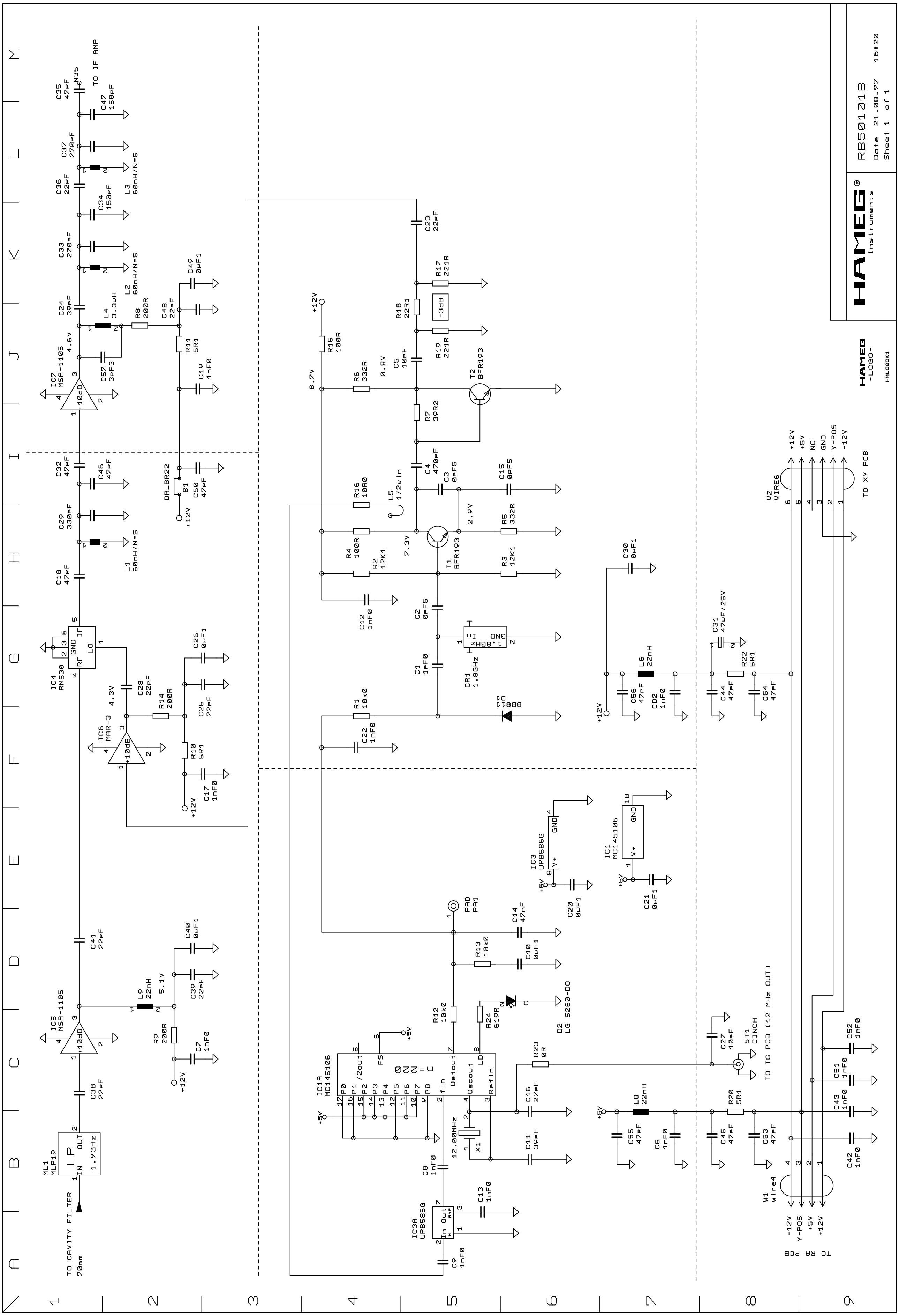
10.1 Position of TG-level has to align in both bandwidths (400kHz and 20kHz). If necessary, align with IF-Amp.
10.2 TG-level knob has to be adjustable from +1 to -10dBm.

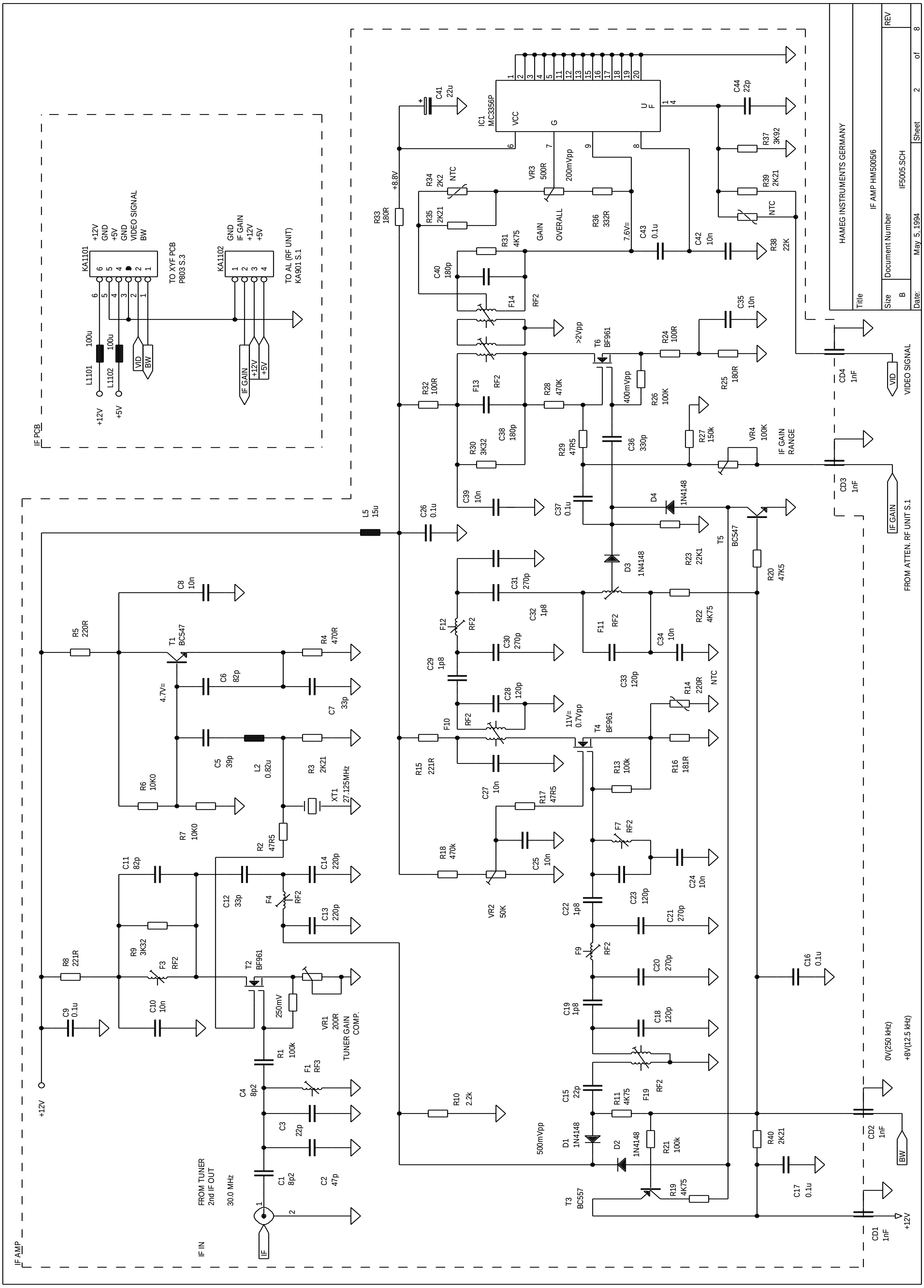
Tracking-Generator



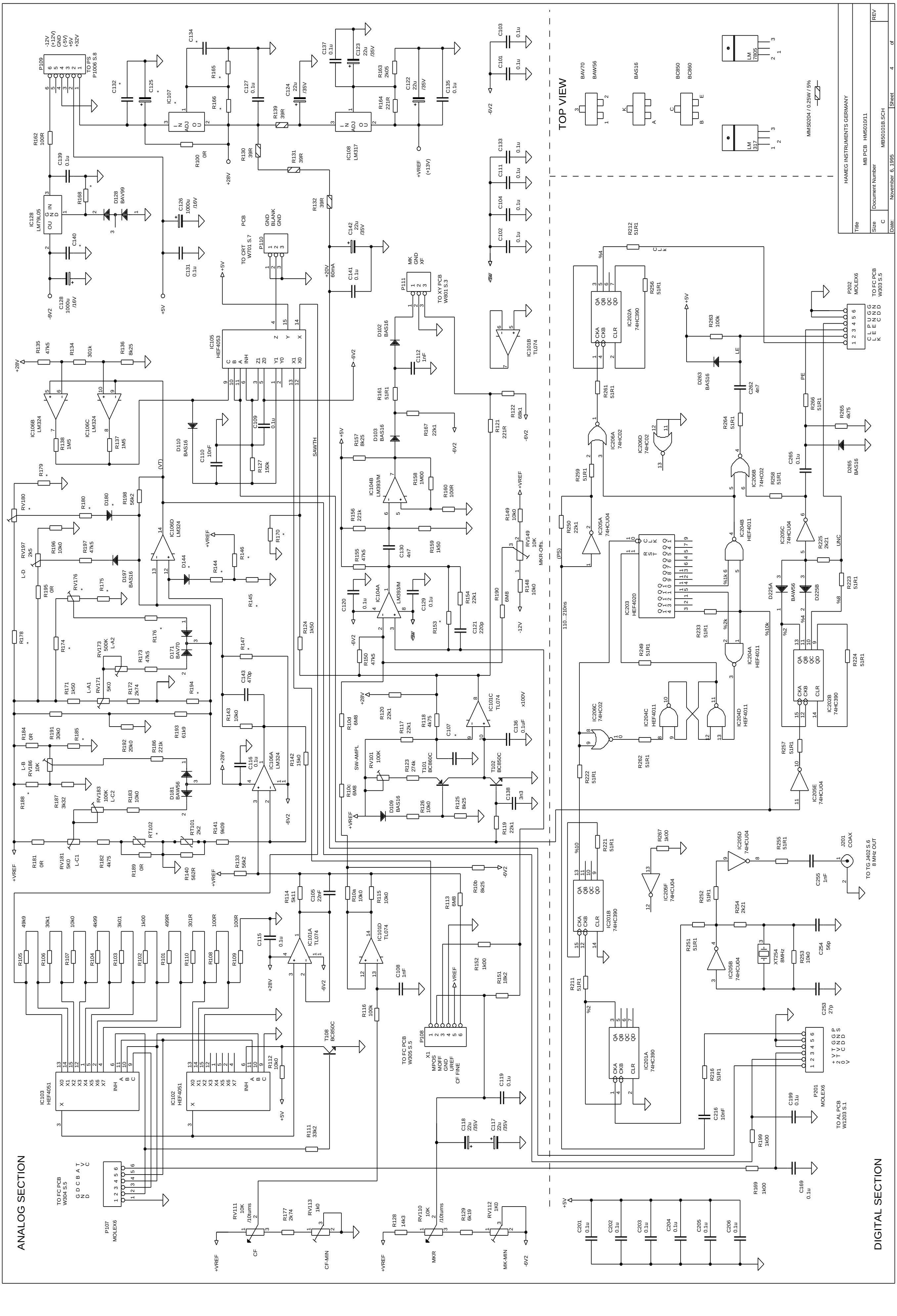

RA50101B
Date 21.08.97 16:21
Sheet 1 of 1
HAMEG Instruments
TO RB5010 PCB
TO MB PCB
ANALYZER INPUT
TO CAVITY FILTER
TO TG (VCO OUT)

Tuner RB-Board

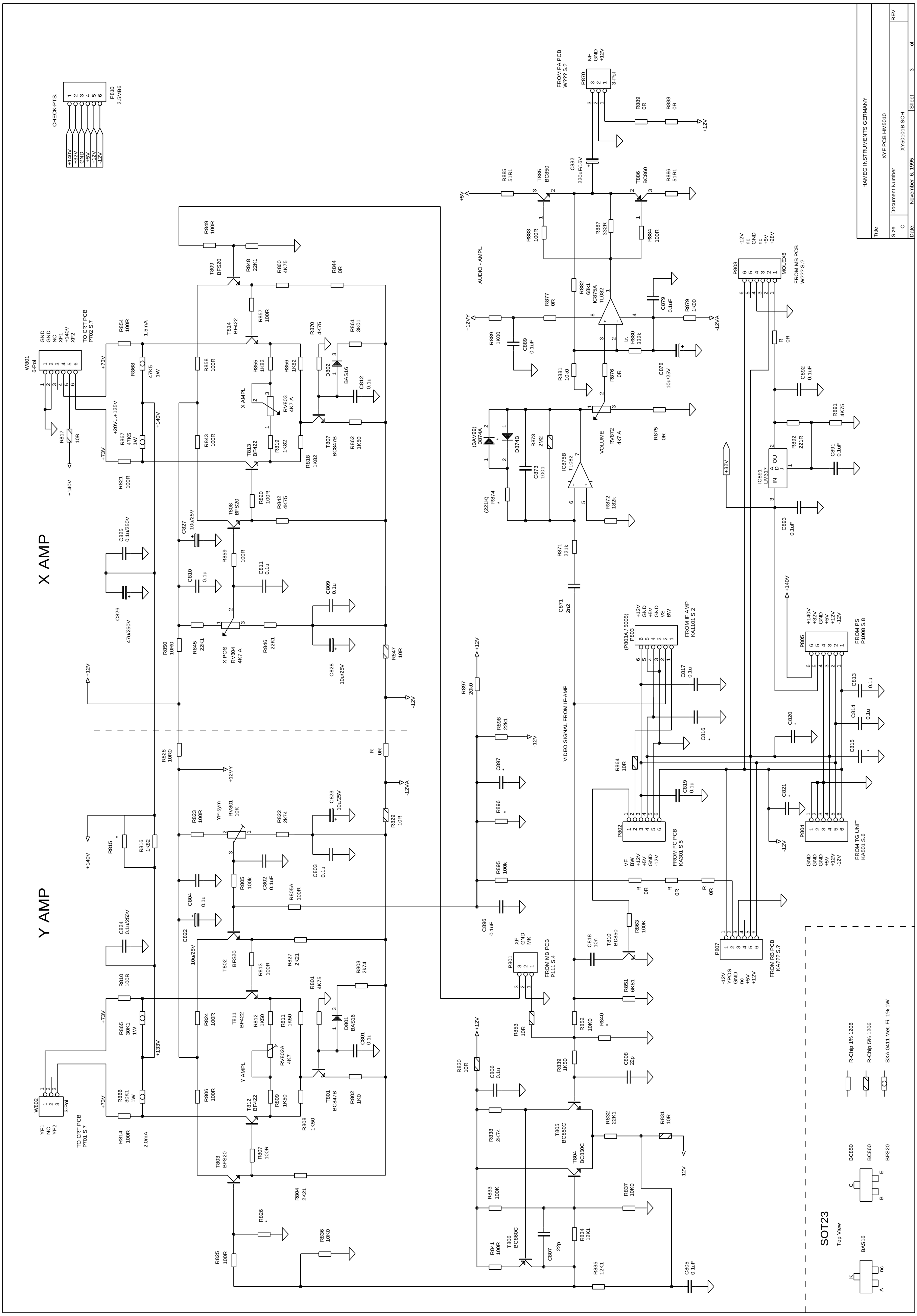



HAMEG INSTRUMENTS GERMANY
Title
IF AMP HM5005/6
Size
B
Document Number
IF5005.SCH
REV
Date:
May 5, 1994
Sheet
2
of
8
IF PCB
IF AMP
IC1
MC3356P
VIDEO SIGNAL
IF GAIN
FROM ATTEN. RF UNIT S.1
FROM TUNER
2nd IF OUT
30.0 MHz
IF IN

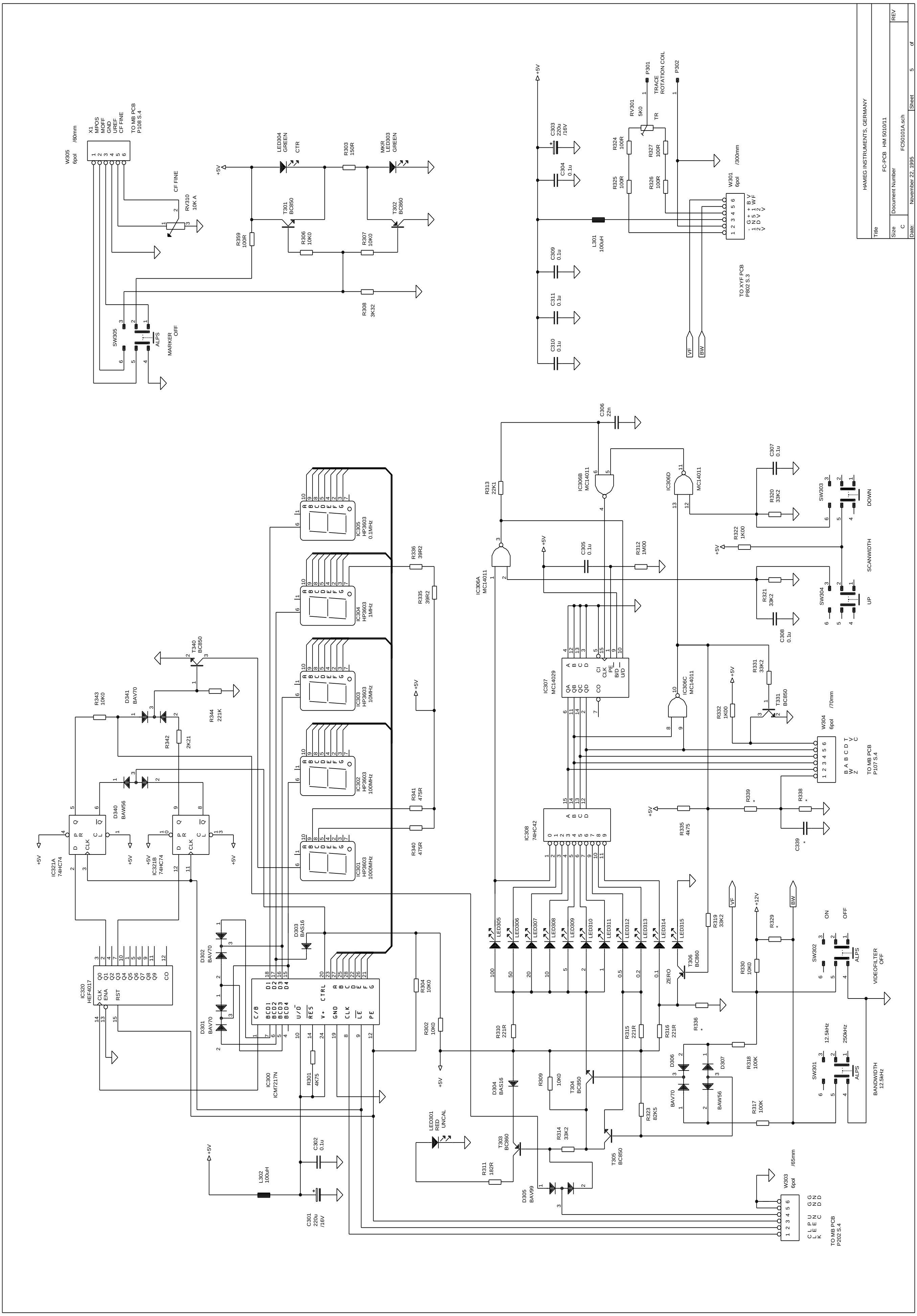
Main board

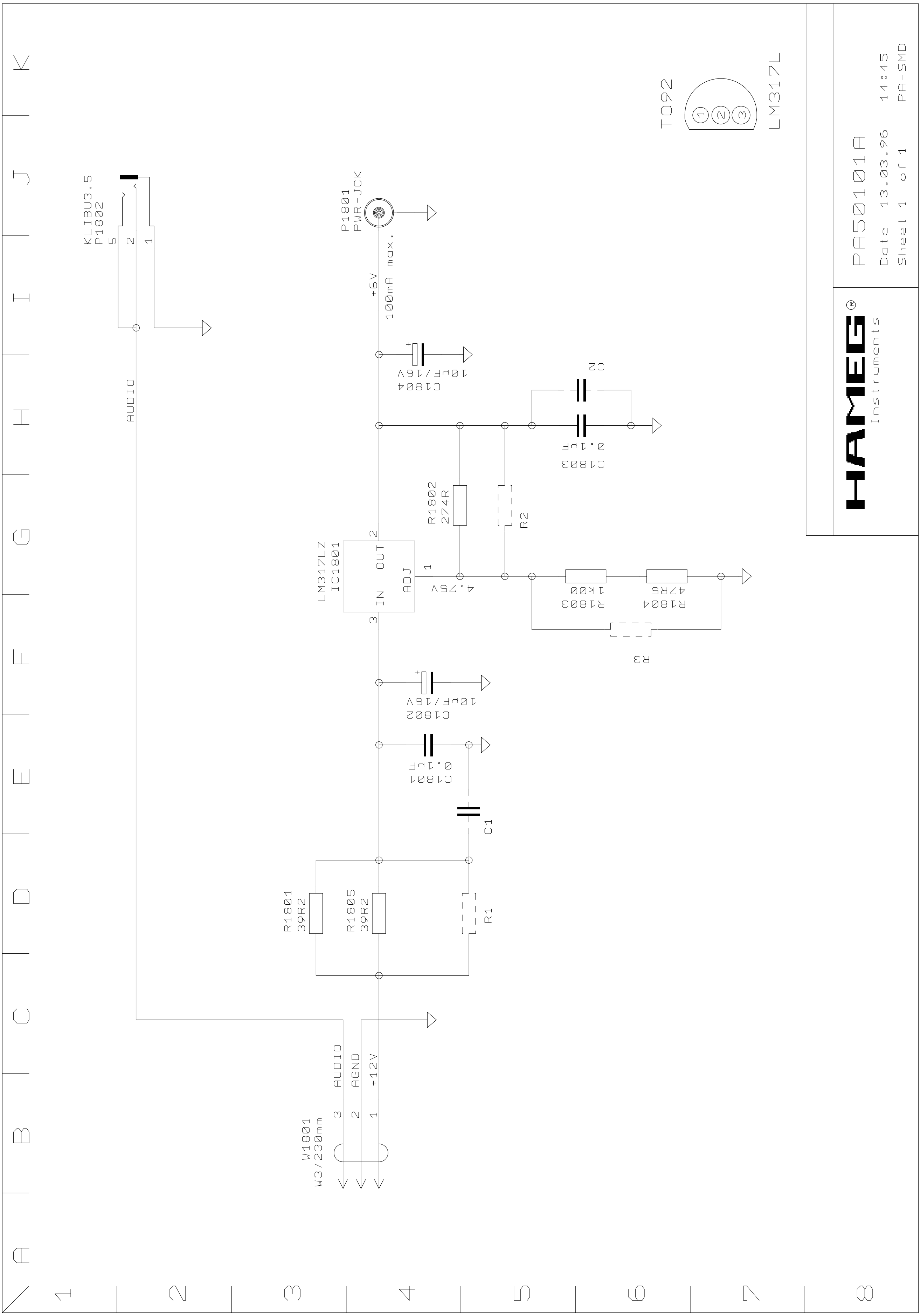


ANALOG SECTION
DIGITAL SECTION
TOP VIEW
HAMEG INSTRUMENTS GERMANY
MB PCB HM5010/11
MB5010B.SCH
November 6, 1995

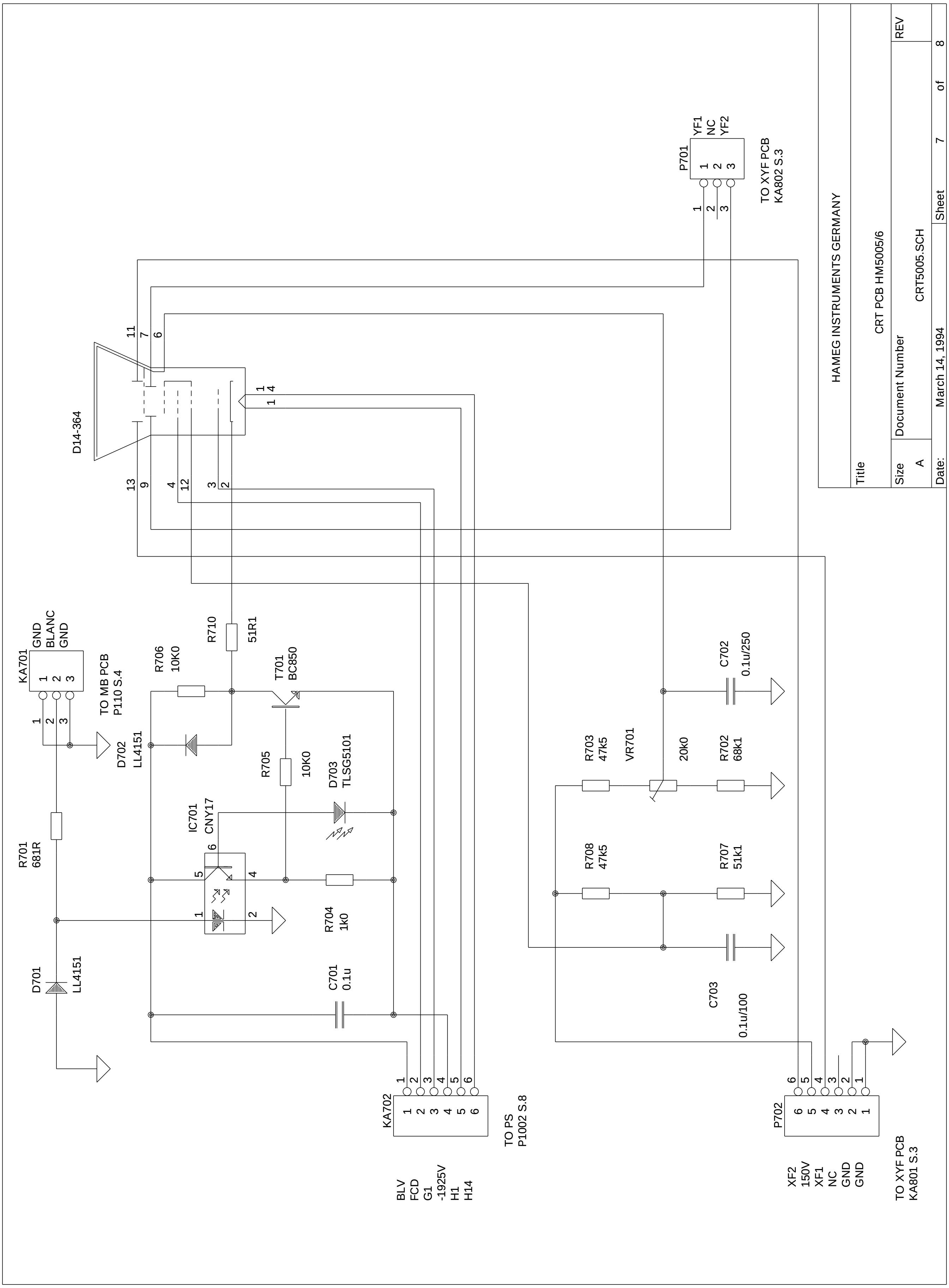

X AMP
Y AMP
AUDIO - AMPL.
VIDEO SIGNAL FROM IF-AMP
SOT23
HAMEG INSTRUMENTS GERMANY
XYF PCB HM5010
XY5010B.SCH
November 6, 1995

FC-Board

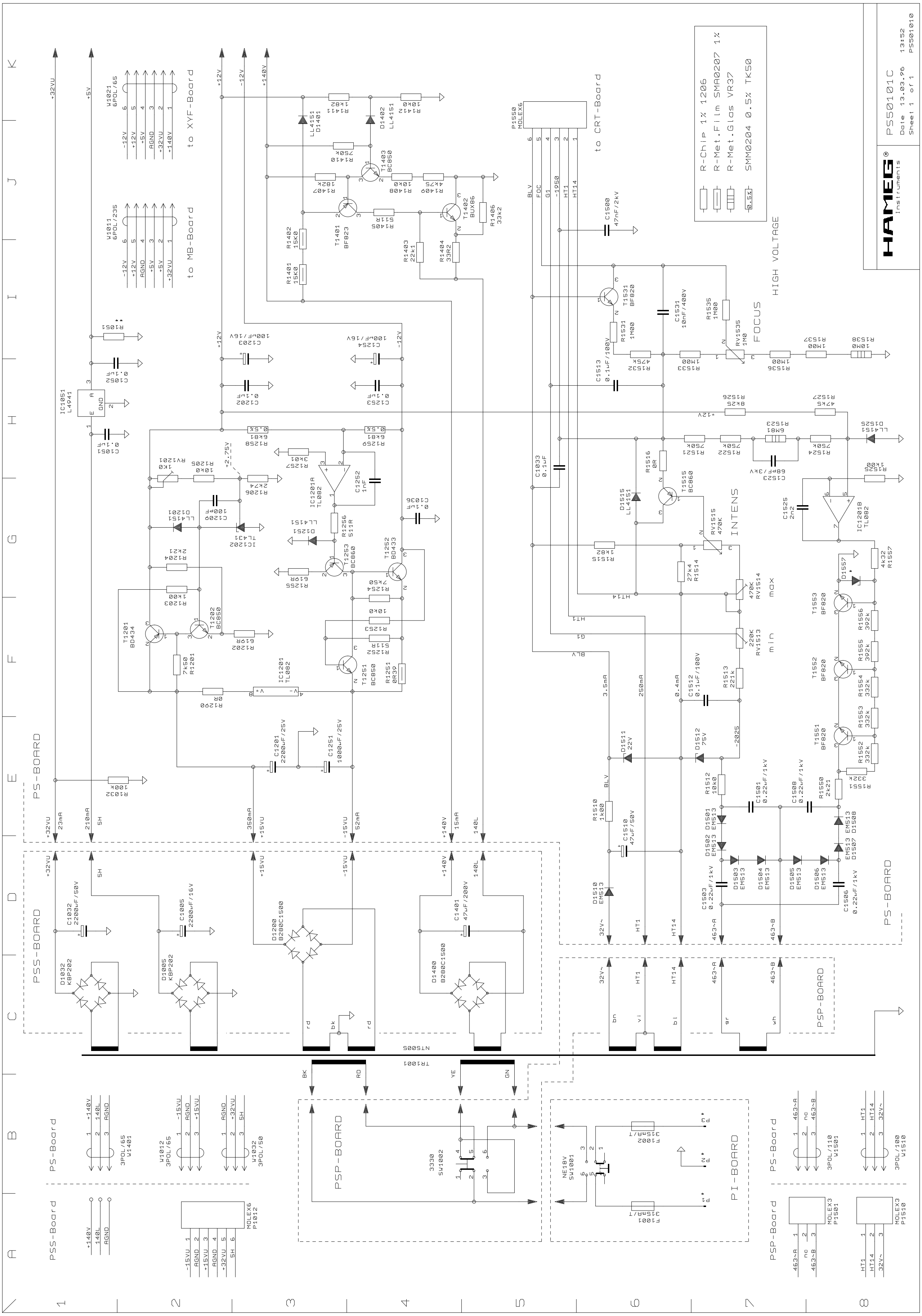



PA50101A
Date 13.03.96 14:45
Sheet 1 of 1 PA-SMD
HAMEG Instruments
TO92
LM317L
KLIBU3.5
P1802
AUDIO
P1801
PWR-JCK
+6V
100mA max.
C1804
10uF/16V
C2
C1803
0.1uF
R1802
274R
R2
LM317LZ
IC1801
IN
OUT
ADJ
4.75V
R1803
1K00
R1804
47R5
R3
C1802
10uF/16V
C1801
0.1uF
C1
R1801
39R2
R1805
39R2
R1
W1801
W3/230mm
AUDIO
AGND
+12V

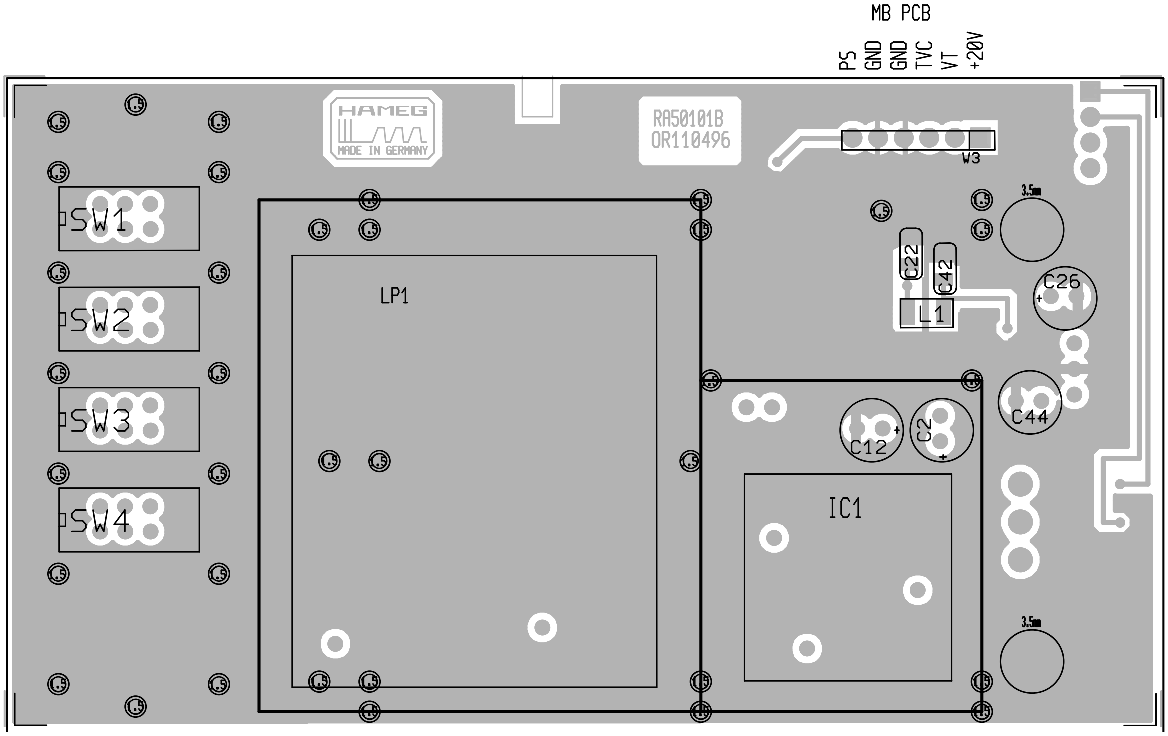
CRT-Board



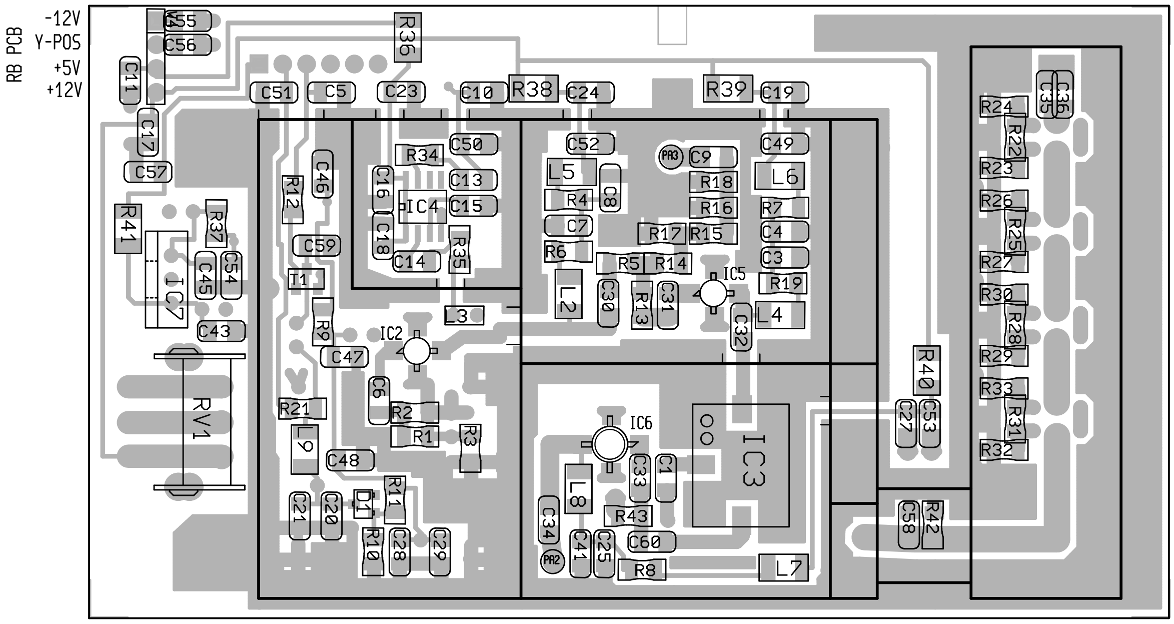
HAMEG INSTRUMENTS GERMANY
Title
CRT PCB HM5005/6
Size
A
Document Number
CRT5005.SCH
REV
Date:
March 14, 1994
Sheet
7
of
8
P701
YF1
NC
YF2
TO XYF PCB
KA802 S.3
D14-364
KA701
GND
BLANC
GND
TO MB PCB
P110 S.4
R701
681R
D701
LL4151
D702
LL4151
R706
10K0
R710
51R1
T701
BC850
R705
10K0
D703
TLSG5101
IC701
CNY17
R704
1k0
C701
0.1u
C702
0.1u/250
R703
47k5
VR701
20k0
R702
68k1
R708
47k5
R707
51k1
C703
0.1u/100
KA702
TO PS
P1002 S.8
BLV
FCD
G1
-1925V
H1
H14
P702
XF2
150V
XF1
NC
GND
GND
TO XYF PCB
KA801 S.3


R-Chip 1% 1206
R-Met.Film SMA0207 1%
R-Met.Glas VR37
SMM0204 0.5% TK50
HAMEG Instruments
PS50101C
Date 13.03.96
Sheet 1 of 1
HIGH VOLTAGE
FOCUS
INTENS
to XYF-Board
to MB-Board
to CRT-Board
PS-BOARD
PSS-BOARD
PSP-BOARD
PI-BOARD
PS-Board
PSS-Board
PSP-Board

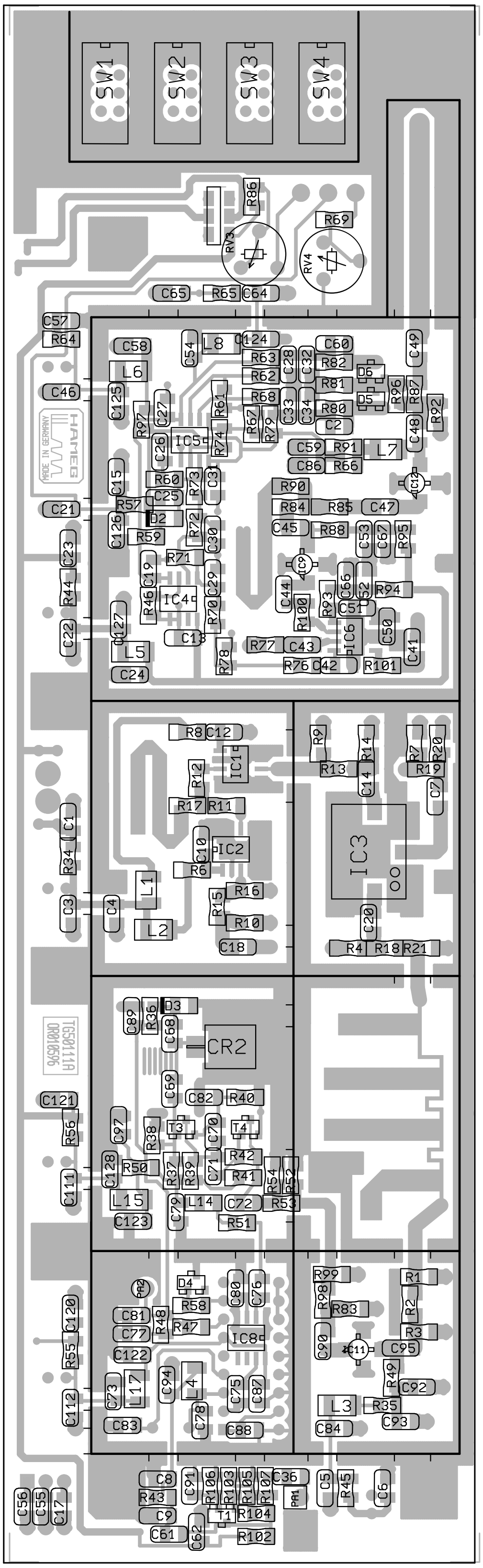
RA-Board



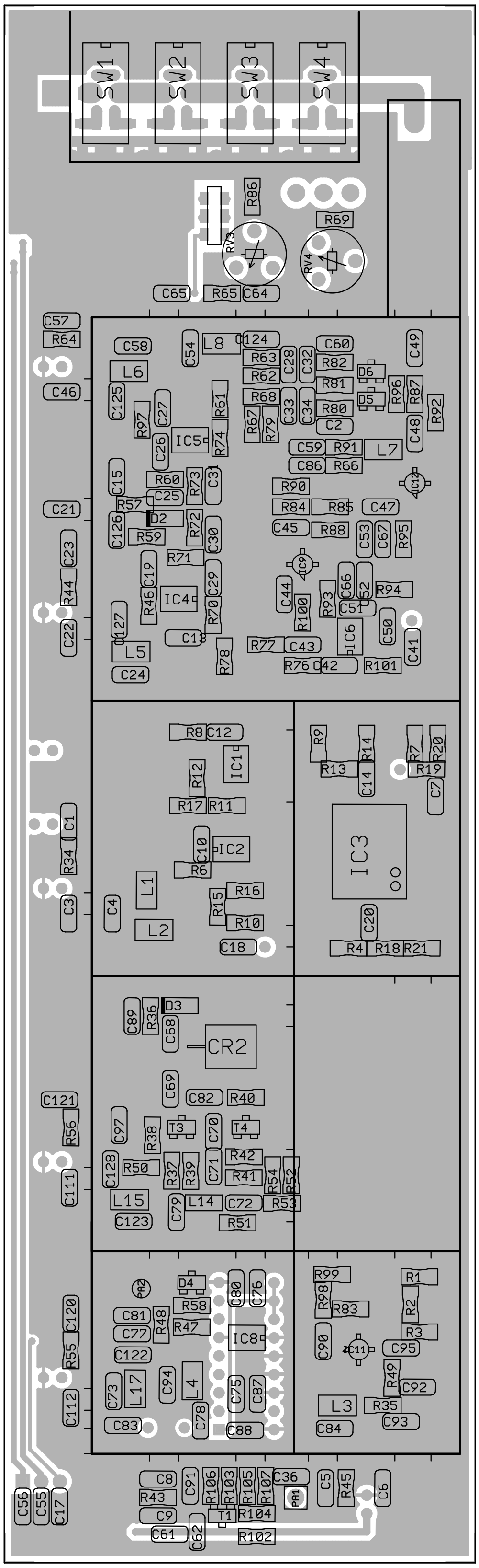
MB PCB
PS
GND
GND
TVC
VT
+20V
HAMEG
MADE IN GERMANY
RA50101B
OR110496
W3
SW1
SW2
SW3
SW4
LP1
C22
C42
L1
C26
C12
C2
C44
IC1



RB PCB
-12V
Y-POS
+5V
+12V
C55
C56
C11
C17
C57
R41
R37
C54
C45
IC7
C43
RV1
R36
C51
C5
C23
C10
R38
C24
R39
C19
R12
C46
C16
C18
R34
C50
C13
IC4
C15
R35
C14
C59
T1
R9
C47
IC2
L3
C6
R2
R1
R3
R21
L9
C48
C21
C20
D1
R11
R10
C28
C29
C52
L5
C8
R4
C7
R6
C9
R18
R16
R17
R15
C49
L6
R7
C4
C3
R5
R14
IC5
R19
L2
C30
R13
C31
C32
L4
IC6
C33
C1
IC3
L8
C34
R43
C60
C41
C25
R8
L7
R40
C27
C53
C58
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R28
R29
R33
R31
R32

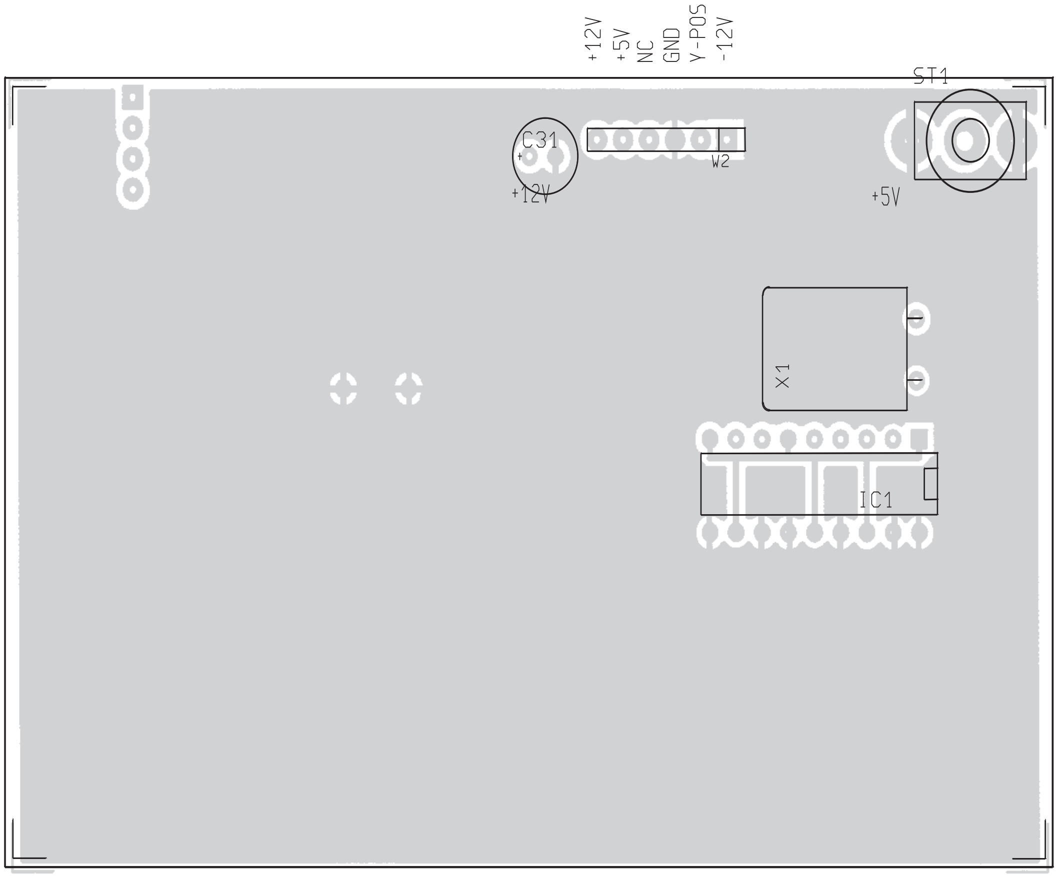


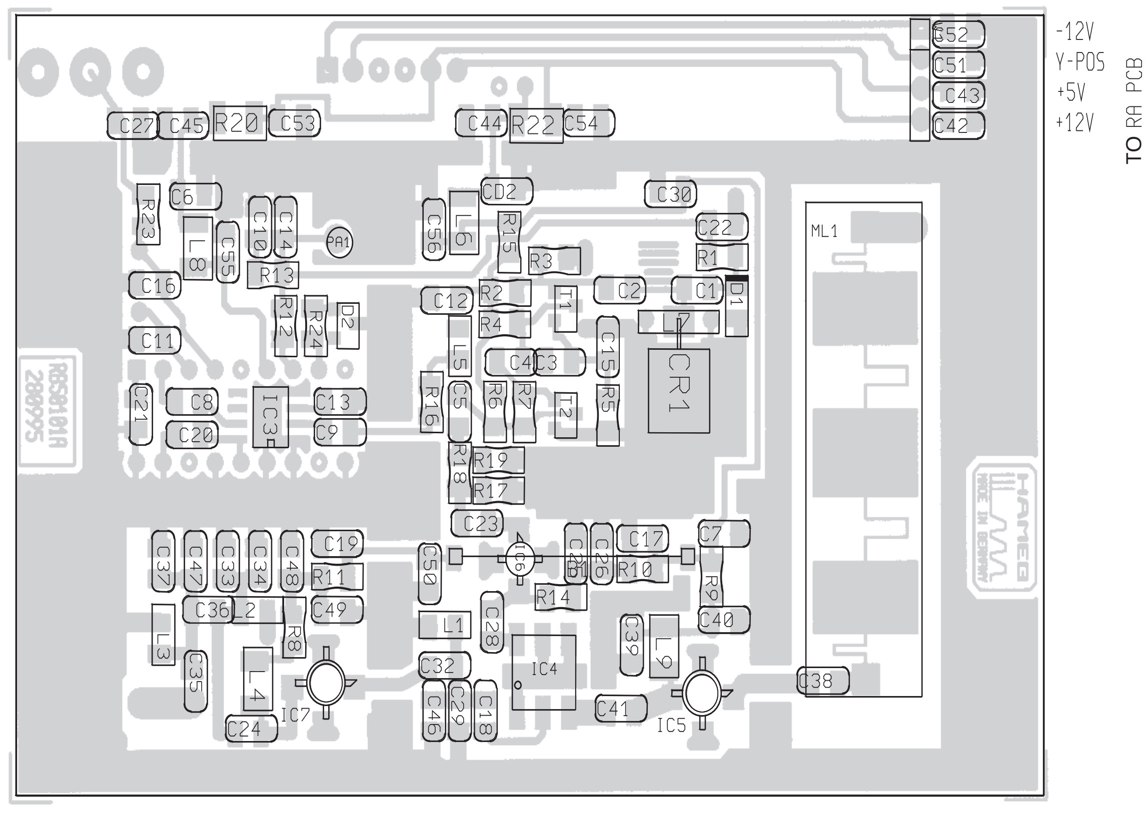
TO RB PCB

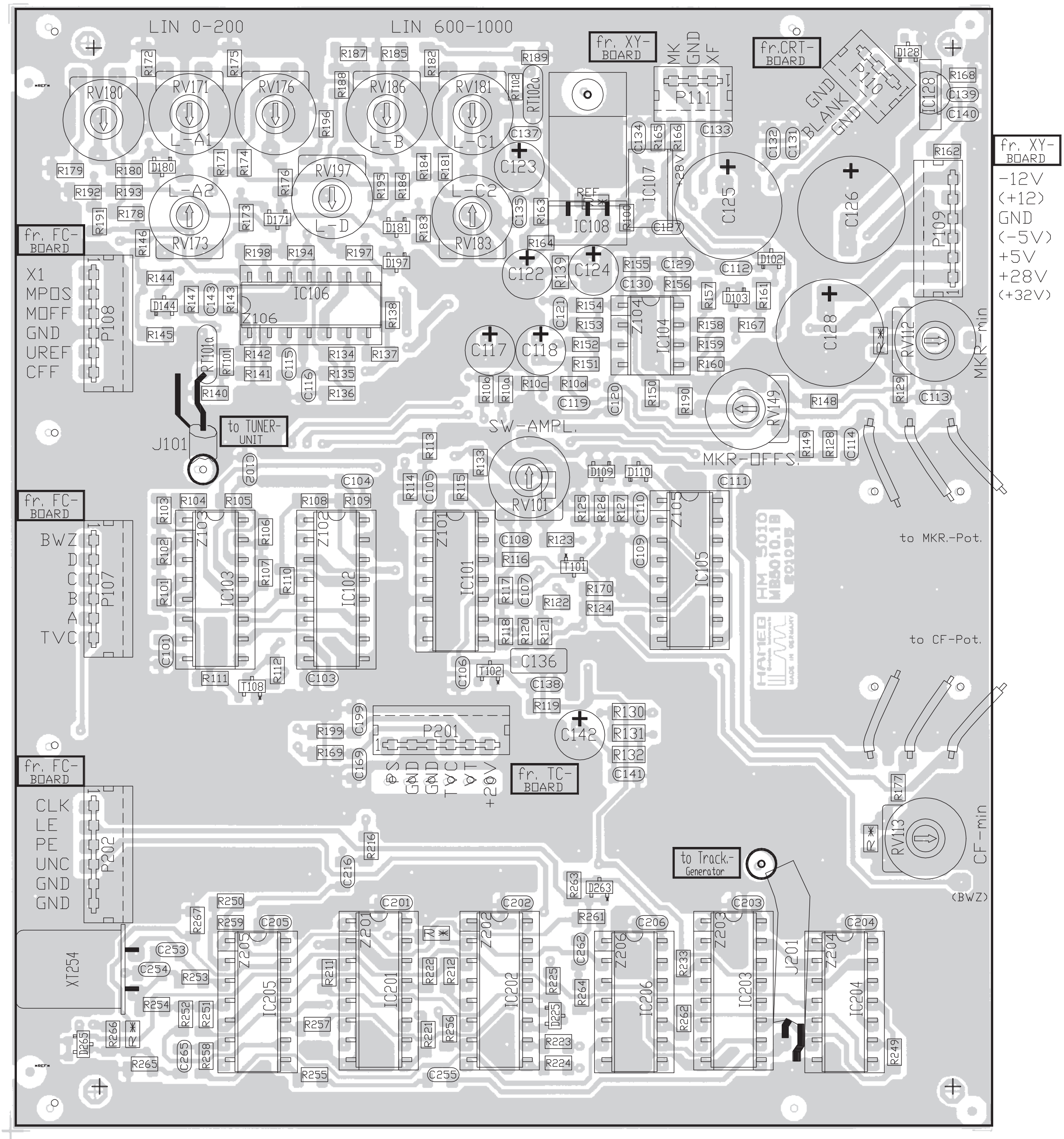


TO RB PCB

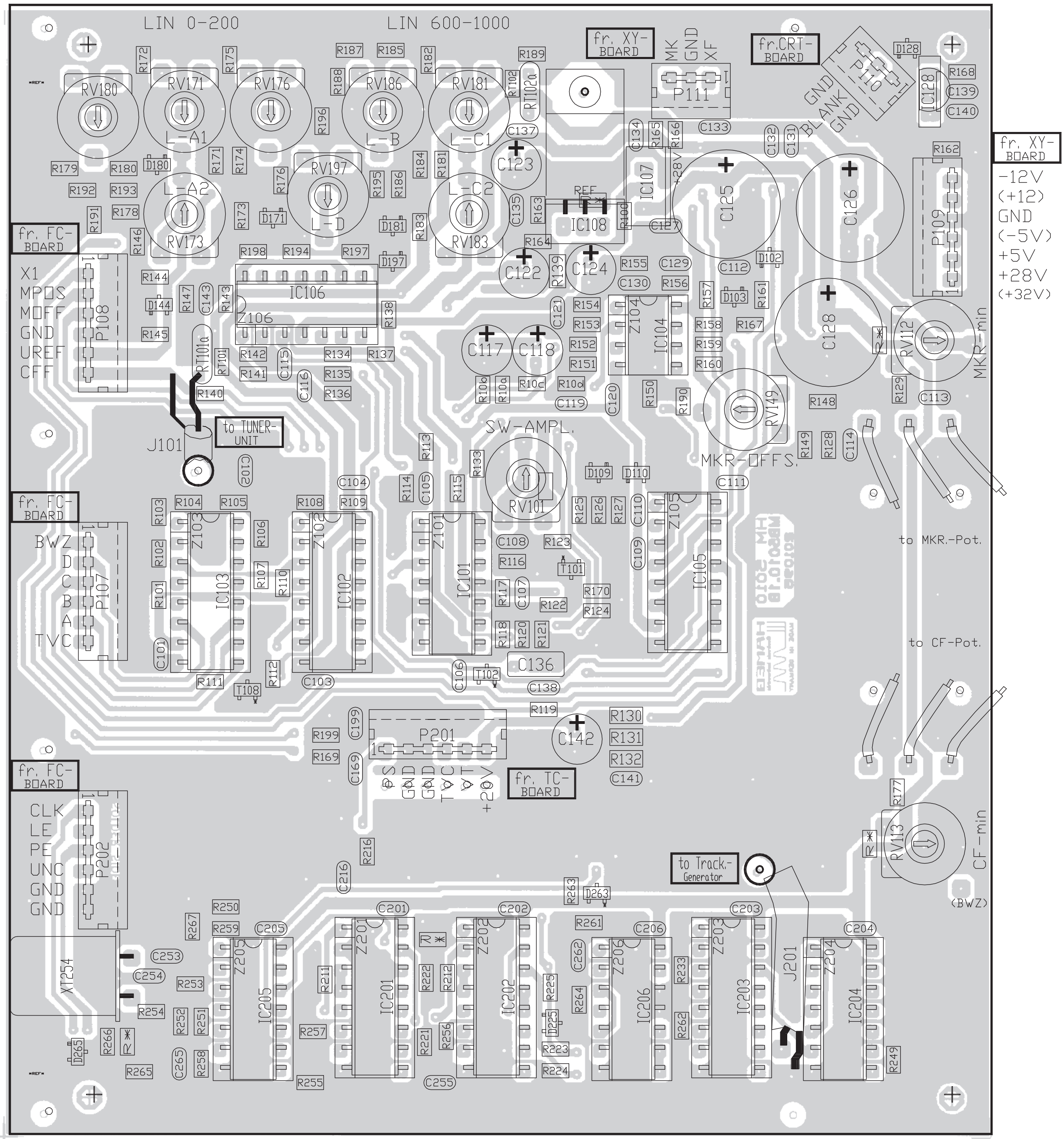
RB-Board


+12V
+5V
NC
GND
Y-POS
-12V
ST1
C31
W2
+12V
+5V
X1
IC1

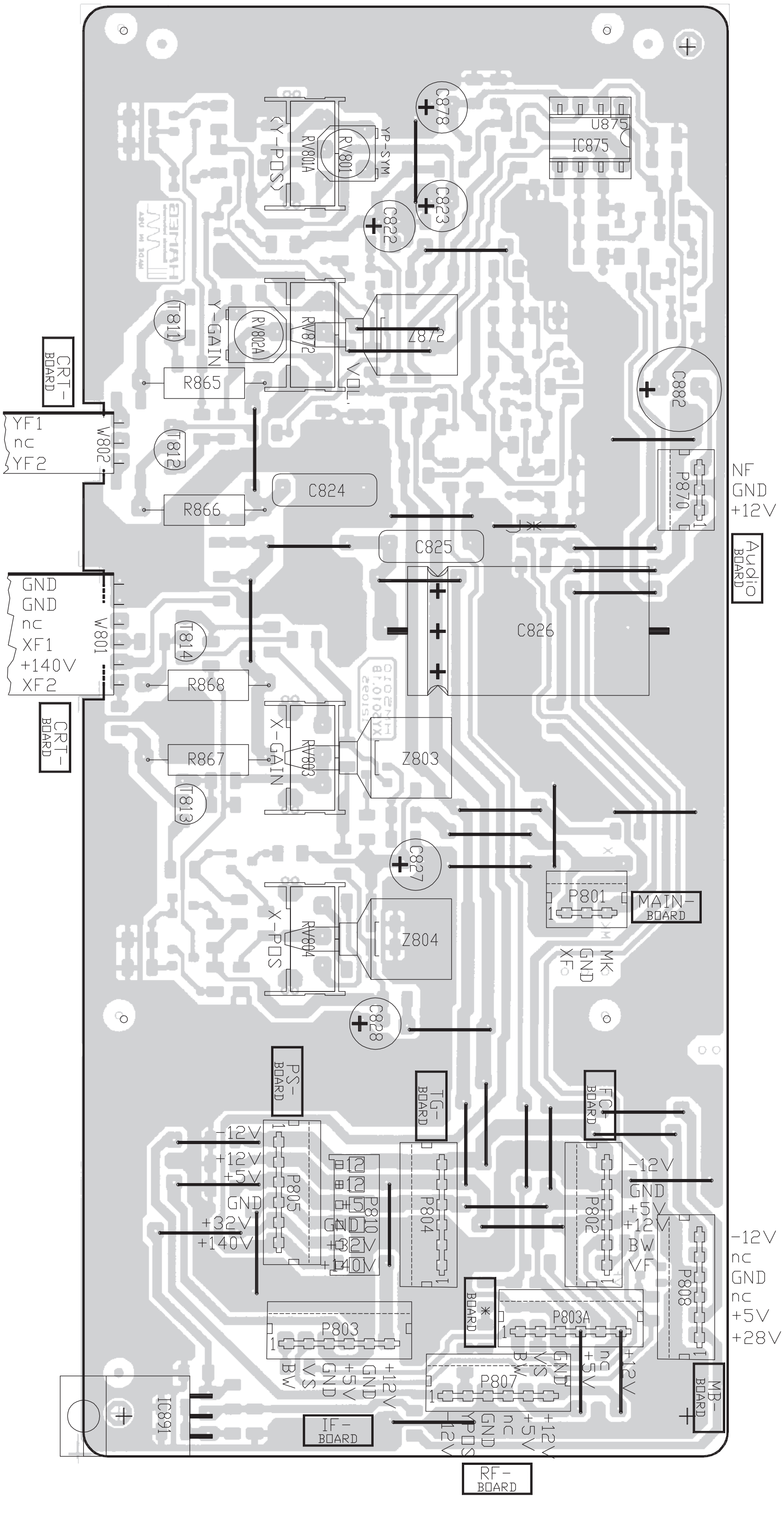

-12V
Y-POS
+5V
+12V
TO RA PCB
C27
C45
R20
C53
C44
R22
C54
C52
C51
C43
C42
C30
C22
R1
C1
D1
CR1
ML1
IC3
IC4
IC5
IC6
IC7
C38
C41
C40



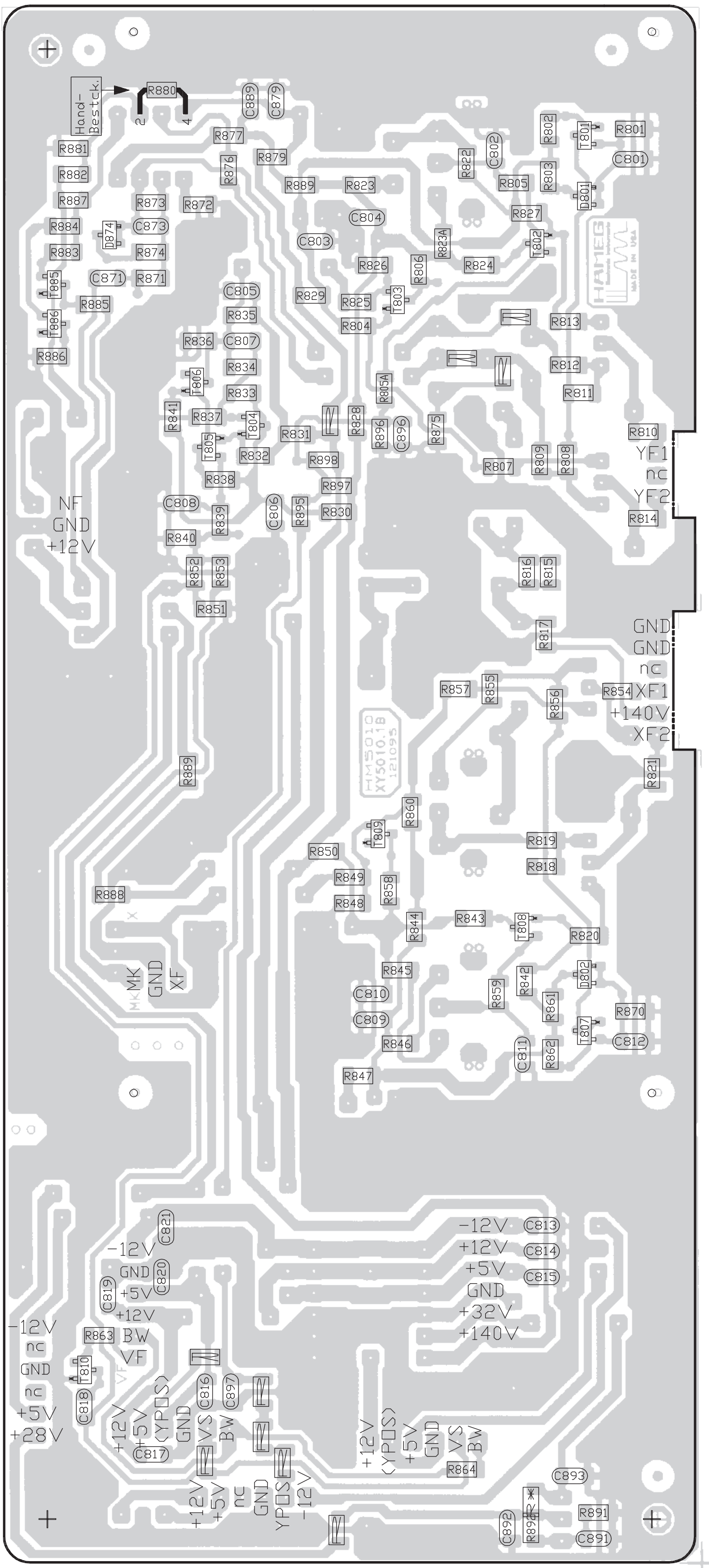
Main board



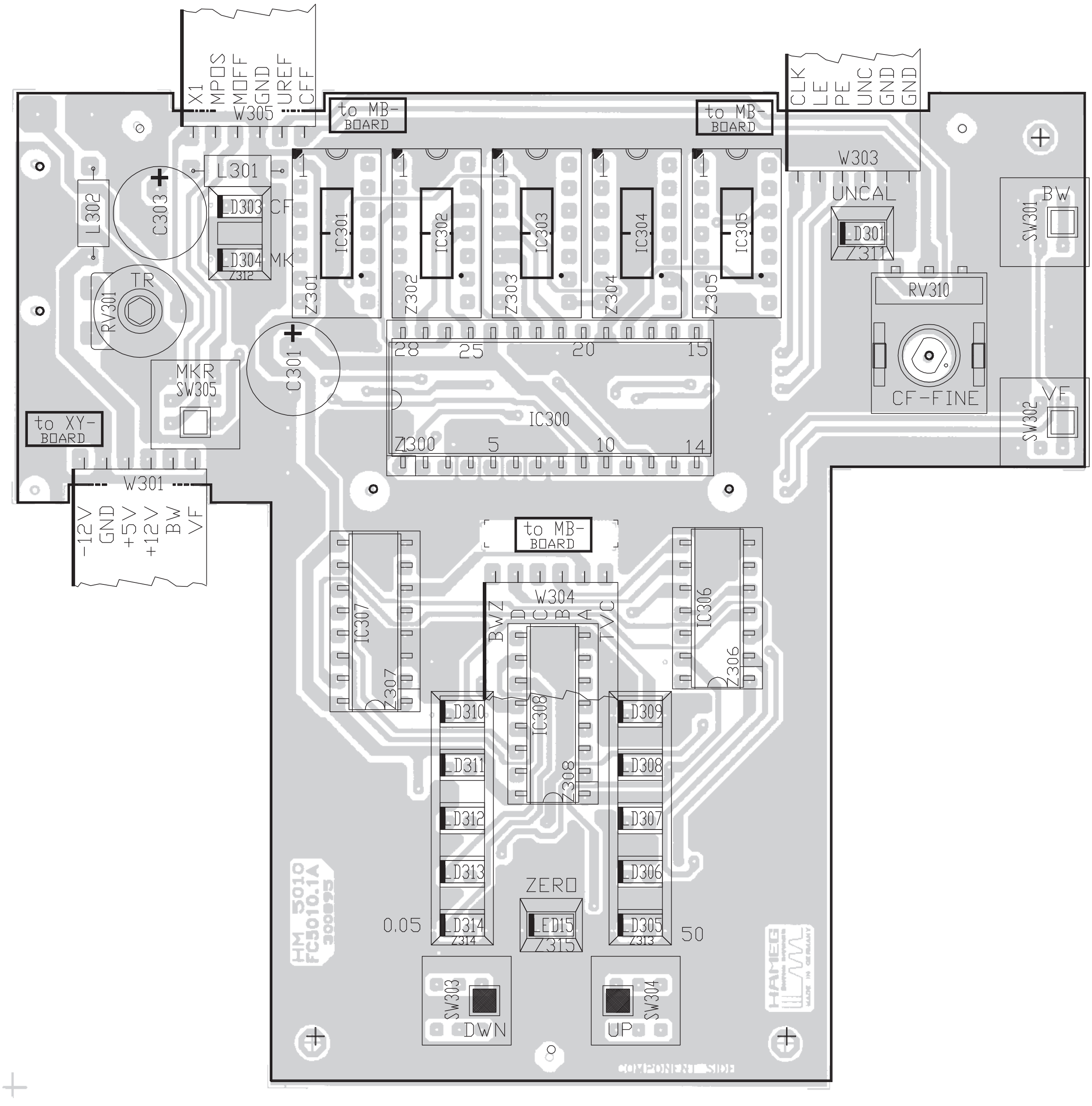
LIN 0-200
LIN 600-1000
fr. XY-BOARD
fr.CRT-BOARD
fr. FC-BOARD
to TUNER-UNIT
SW-AMPL.
MKR-OFFS.
MKR-min
to MKR.-Pot.
to CF-Pot.
fr. TC-BOARD
to Track-Generator
CF-min
(BWZ)
-12V
(+12)
GND
(-5V)
+5V
+28V
(+32V)
X1
MPOS
MOFF
GND
UREF
CFF
BWZ
D
C
B
A
TVC
CLK
LE
PE
UNC
GND
GND


CRT-BOARD
YF1
nc
YF2
W802
GND
GND
nc
XF1
+140V
XF2
W801
CRT-BOARD
R865
R866
R868
R867
C824
C825
C826
C878
C823
C822
C882
C827
C828
RV801A
RV801
RV802A
RV872
RV803
RV804
Y-GAIN
X-GAIN
X-POS
YP-SYM
Z872
Z803
Z804
IC875
U875
P870
NF
GND
+12V
Audio BOARD
P801
MAIN-BOARD
MK
GND
XF
PS-BOARD
TG-BOARD
FC-BOARD
P805
-12V
+12V
+5V
GND
+32V
+140V
P810
P804
P802
-12V
GND
+5V
+12V
BW
VF
P808
-12V
nc
GND
nc
+5V
+28V
P803
P803A
P807
IC891
IF-BOARD
RF-BOARD
MB-BOARD

XY-Board

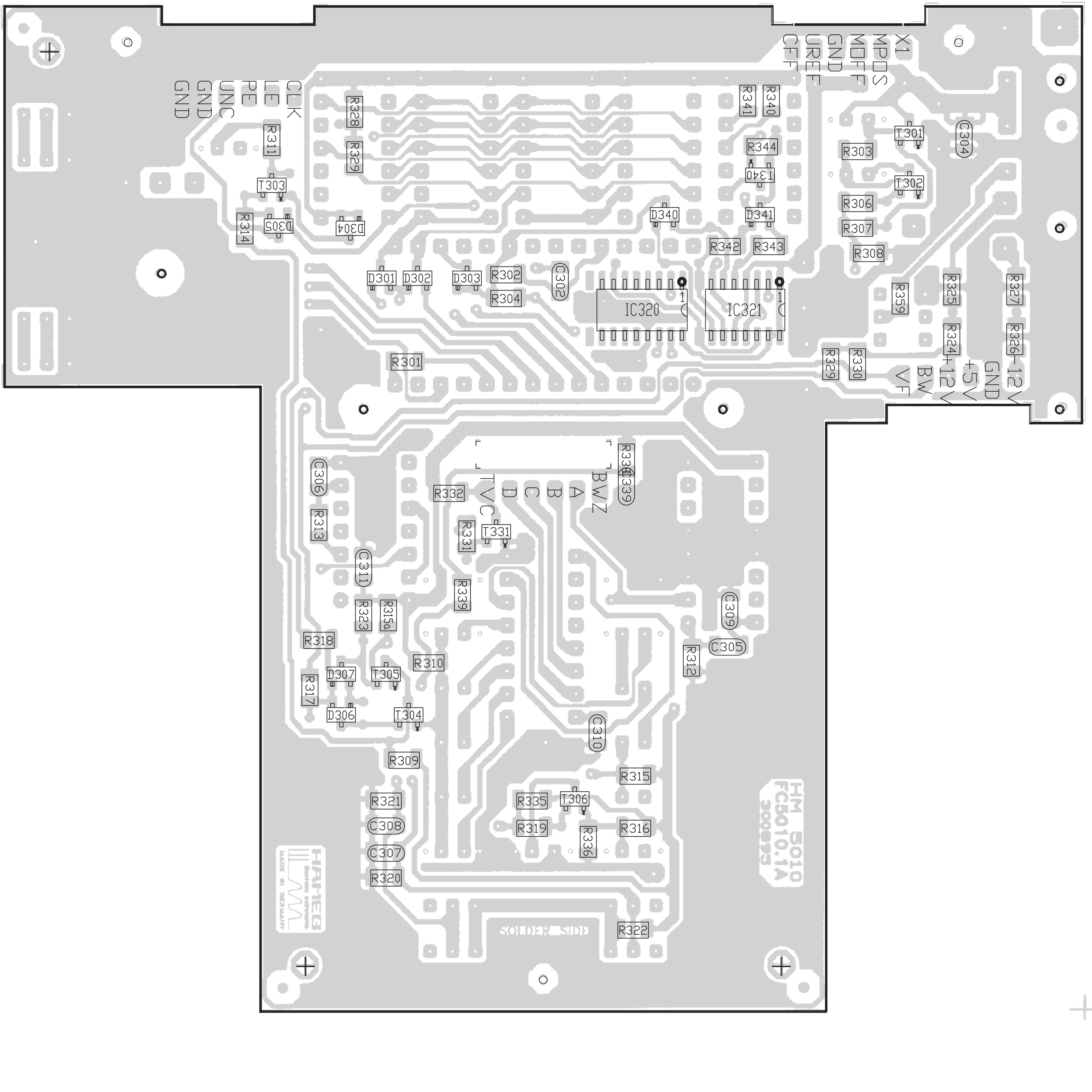


Hand-Bestck.
R880
C889
C879
R877
R879
R876
R881
R882
R887
R884
R883
R885
T885
T886
R886
R873
C873
R874
C871
R871
R872
D874
R889
R823
C804
C803
R826
R829
R825
R804
C805
R835
R836
C807
R834
R833
T806
R837
R841
T804
T805
R831
R832
R838
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R897
R830
C808
R839
C806
R895
R840
R852
R853
R851
R828
R896
C896
R875
R805A
T803
R806
R824
R823A
R822
C802
R802
T801
R801
C801
R803
R805
D801
R827
T802
R813
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GND
GND
nc
XF1
+140V
XF2
R857
R855
R856
R854
R821
HM5010
XY5010.1B
R889
R860
T809
R850
R849
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R858
R844
R843
T808
R819
R818
R820
R888
MK
GND
XF
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C810
C809
R846
R847
R859
R842
R861
D802
R870
T807
C812
C811
R862
C821
-12V
GND
+5V
+12V
BW
VF
C819
C820
R863
T810
C818
-12V
nc
GND
nc
+5V
+28V
C816
C897
+12V
+5V
(YP□S)
GND
VS
BW
C817
+12V
+5V
nc
GND
YP□S
-12V
-12V
+12V
+5V
GND
+32V
+140V
C813
C814
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(YP□S)
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VS
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R894
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C891

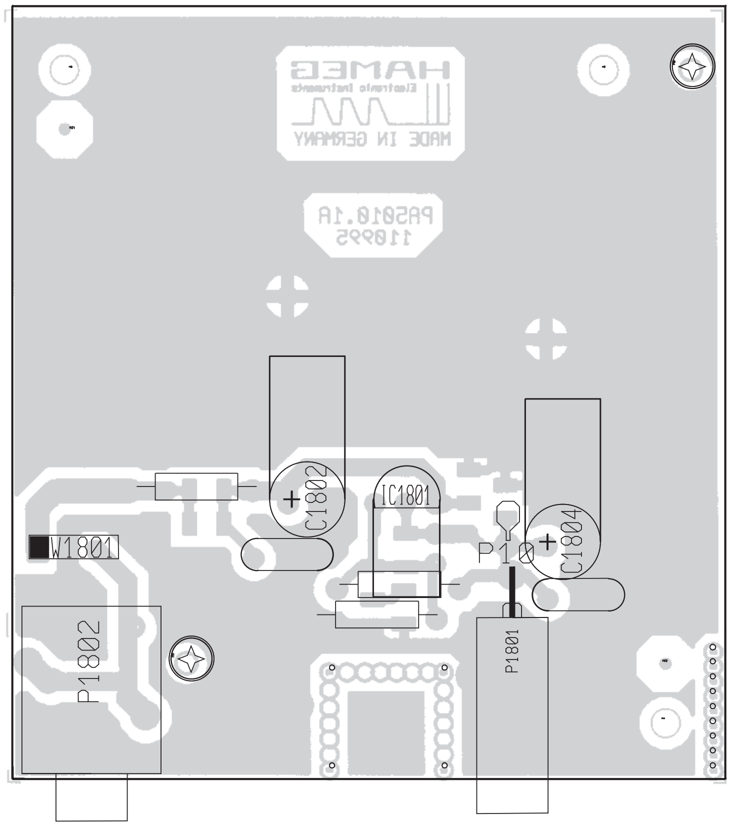


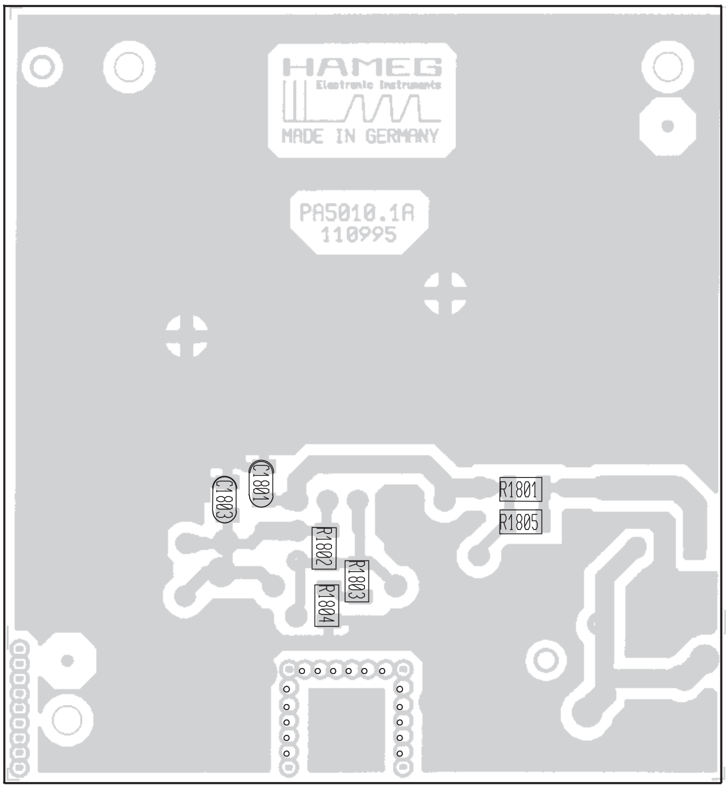
X1
MPOS
MOFF
GND
UREF
CFF
W305
to MB-BOARD
CLK
LE
PE
UNC
GND
GND
W303
UNCAL
D301
Z311
BW
SW301
L301
L302
C303
D303 CF
D304 MK
Z312
TR
RV301
IC301
IC302
IC303
IC304
IC305
Z301
Z302
Z303
Z304
Z305
RV310
CF-FINE
VF
SW302
C301
MKR
SW305
to XY-BOARD
IC300
Z300
28
25
20
15
5
10
14
W301
-12V
GND
+5V
+12V
BW
VF
W304
BWZ
D
C
B
A
TVC
IC307
Z307
IC306
Z306
IC308
Z308
D310
D311
D312
D313
D314
Z314
D309
D308
D307
D306
D305
Z313
ZERO
LED15
Z315
0.05
50
SW303
DWN
SW304
UP
HM 5010
FC5010.1A
HAMEG
COMPONENT SIDE

FC-Board

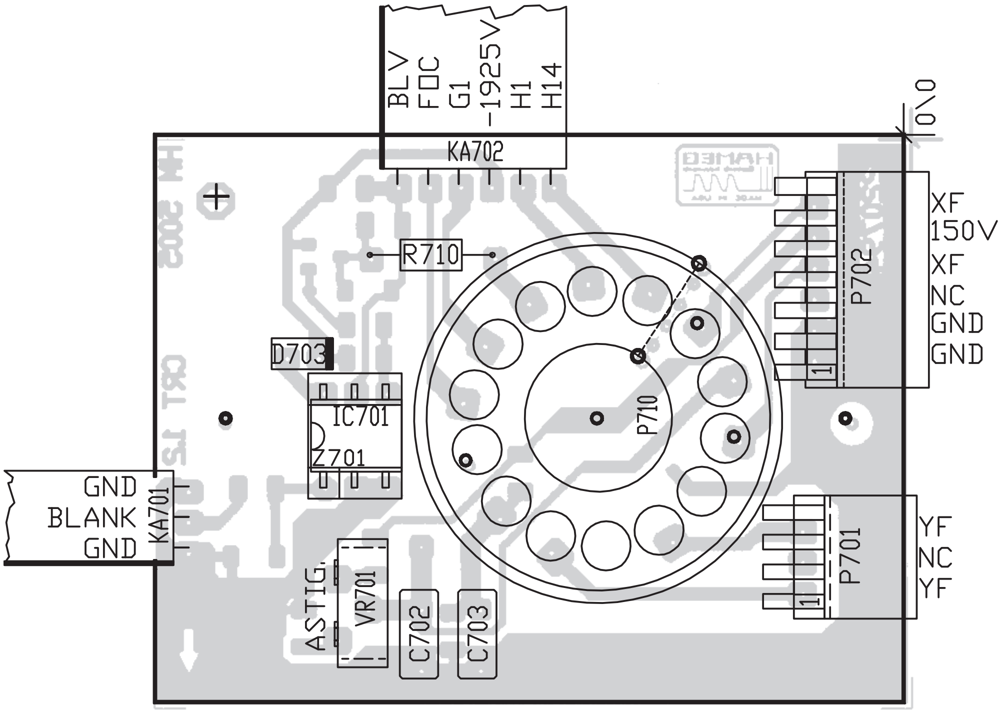


 Subject to change without notice

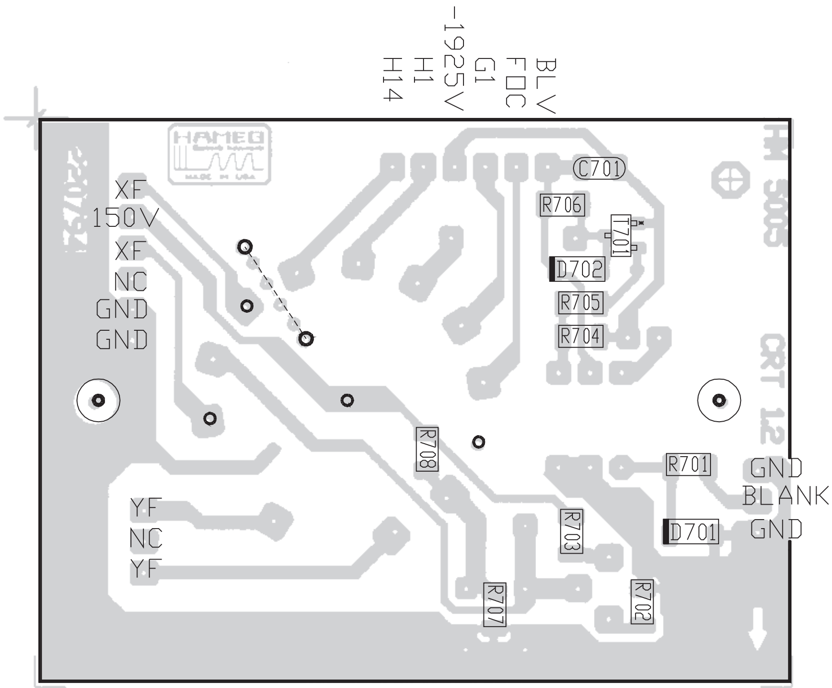

HAMEG
Electronic Instruments
MADE IN GERMANY
PA5010.1A
110995
C1802
IC1801
C1804
W1801
P1802
P1801


HAMEG
Electronic Instruments
MADE IN GERMANY
PA5010.1A
110995
C1801
C1803
R1801
R1805
R1802
R1803
R1804

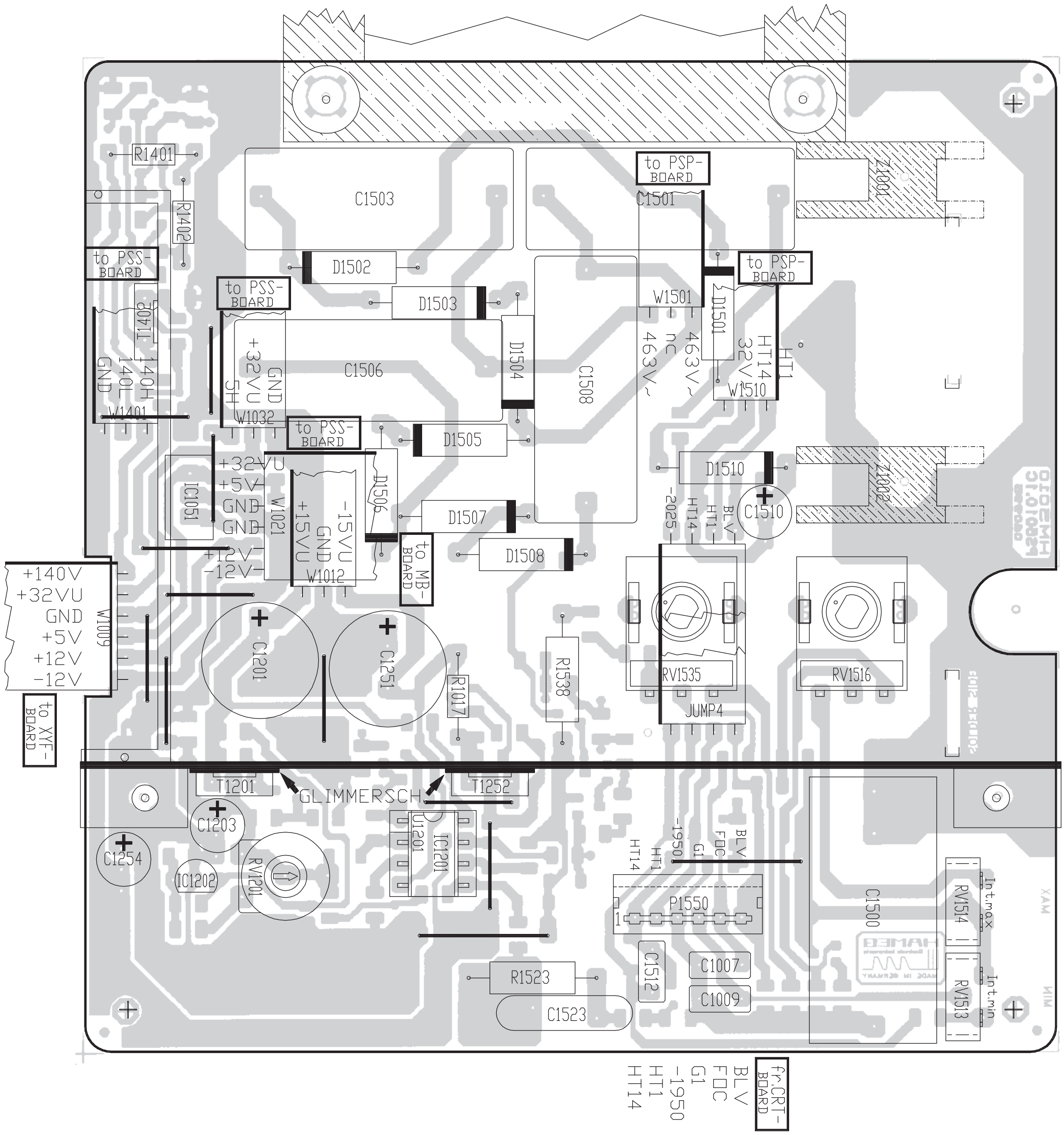
CRT-Board



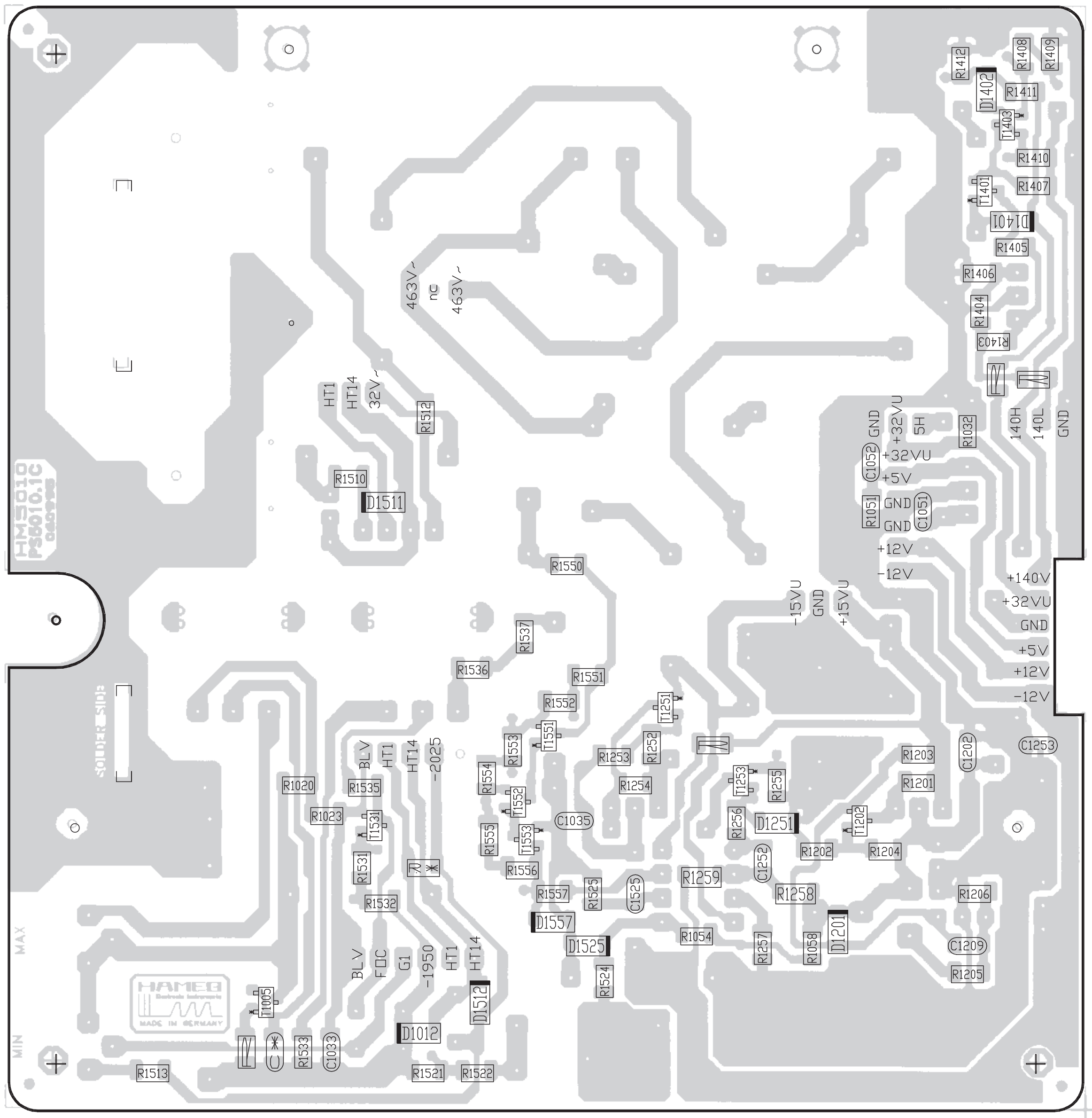
BLV
FDC
G1
-1925V
H1
H14
KA702
R710
D703
IC701
Z701
P710
P702
XF
150V
XF
NC
GND
GND
GND
BLANK
GND
KA701
ASTIG.
VR701
C702
C703
P701
YF
NC
YF

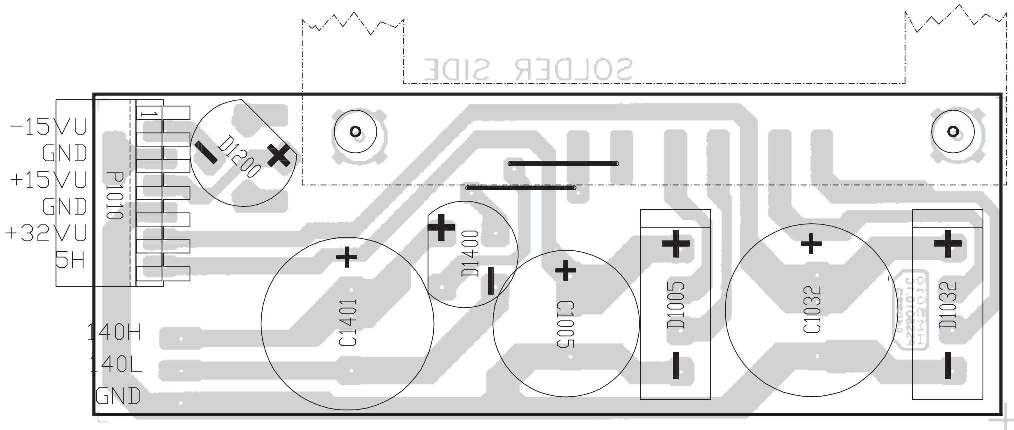


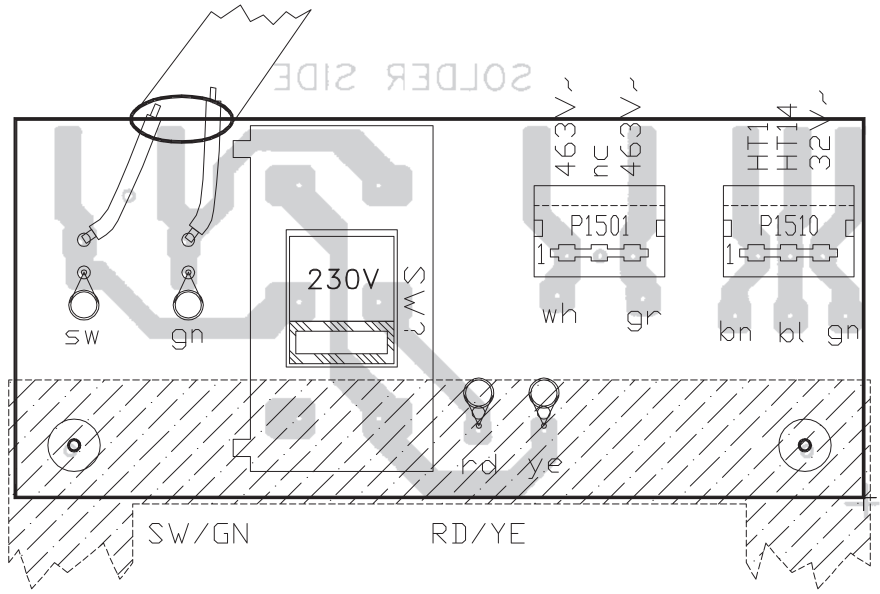
BLV
FDC
G1
-1925V
H1
H14
C701
R706
T701
D702
R705
R704
XF
150V
XF
NC
GND
GND
R708
R701
GND
BLANK
GND
D701
R703
R707
R702
YF
NC
YF

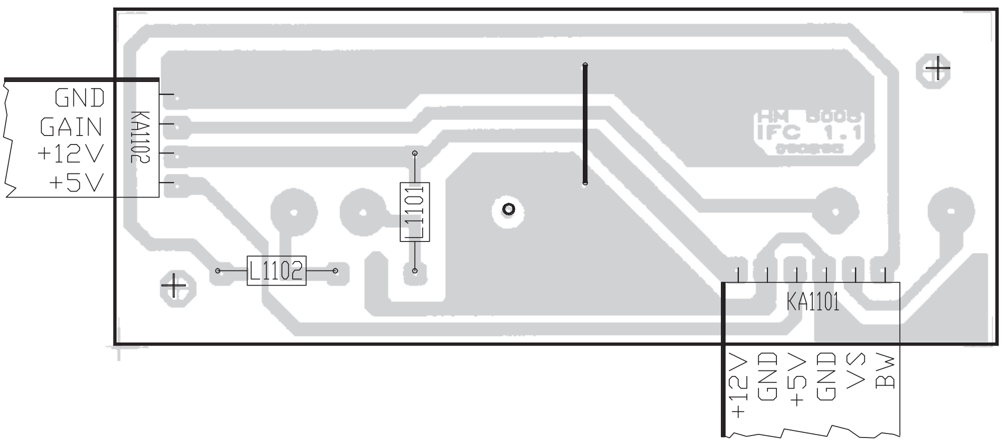

R1401
R1402
C1503
C1501
to PSP-BOARD
to PSS-BOARD
D1502
D1503
D1501
W1501
HT1
HT14
32V
W1510
463V~
nc
463V~
C1506
D1504
C1508
+32VU
GND
5H
W1032
140H
140L
GND
W1401
T1402
D1505
D1506
D1507
D1508
D1510
C1510
-2025
HT14
HT1
BLV
IC1051
+32VU
+5V
GND
GND
W1021
+15VU
GND
-15VU
+12V
-12V
W1012
to MB-BOARD
+140V
+32VU
GND
+5V
+12V
-12V
W1009
to XYF-BOARD
C1201
C1251
R1017
R1538
RV1535
JUMP4
RV1516
T1201
GLIMMERSCH
T1252
C1203
C1254
IC1202
RV1201
U1201
IC1201
BLV
FOC
G1
-1950
HT1
HT14
P1550
C1500
RV1514
Int.max
RV1513
Int.min
C1512
C1007
C1009
R1523
C1523
fr.CRT-BOARD
BLV
FOC
G1
-1950
HT1
HT14

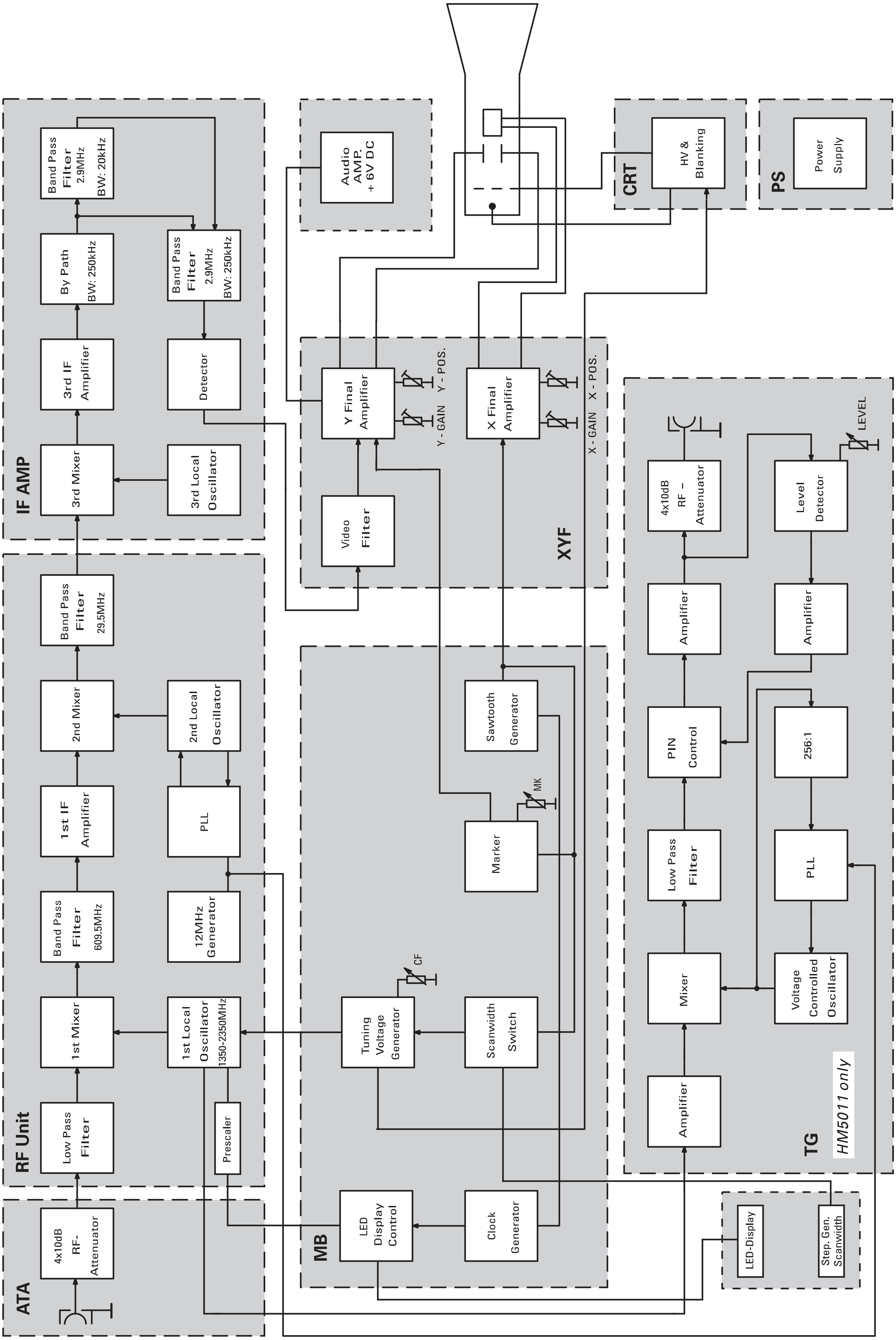
PS-Board


R1412
R1408
R1409
D1402
R1411
T1403
R1410
T1401
R1407
D1401
R1405
R1406
R1404
R1403
463V~
nc
463V~
HT1
HT14
32V~
R1512
R1510
D1511
HM5010
PS5010.1C
GND
+32VU
5H
R1032
140H
140L
GND
C1052
+32VU
+5V
R1051
GND
C1051
GND
+12V
-12V
R1550
-15VU
GND
+15VU
+140V
+32VU
GND
+5V
+12V
-12V
R1537
R1536
R1551
R1552
T1251
SOLDER SIDE
BLV
HT1
HT14
-2025
R1553
T1551
R1253
R1252
R1203
C1202
C1253
R1020
R1535
R1554
R1254
T1253
R1255
R1201
R1023
T1531
T1552
C1035
R1256
D1251
T1202
R1555
T1553
R1202
R1204
R1531
R1556
C1252
R1259
R1532
R1557
R1525
C1525
R1258
R1206
MAX
D1557
R1054
D1525
R1257
R1058
D1201
C1209
BLV
FOC
G1
-1950
HT1
HT14
R1524
R1205
HAMEG
MADE IN GERMANY
T1005
D1512
MIN
D1012
R1533
C1033
R1513
R1521
R1522


SOLDER SIDE
−15VU
GND
+15VU
GND
+32VU
5H
P1010
D1200
D1400
C1401
C1005
D1005
C1032
D1032
140H
140L
GND


SOLDER SIDE
463V~
nc
463V~
HT1
HT14
32V~
P1501
P1510
230V
SW?
sw
gn
wh
gr
bn
bl
gn
rd
ye
SW/GN
RD/YE


GND
GAIN
+12V
+5V
KA1102
L1101
L1102
KA1101
+12V
GND
+5V
GND
VS
BW



IF AMP
Band Pass Filter 2.9MHz BW: 20kHz
By Path BW: 250kHz
Band Pass Filter 2.9MHz BW: 250kHz
3rd IF Amplifier
Detector
3rd Mixer
3rd Local Oscillator
RF Unit
Band Pass Filter 29.5MHz
2nd Mixer
2nd Local Oscillator
1st IF Amplifier
PLL
Band Pass Filter 609.5MHz
12MHz Generator
1st Mixer
1st Local Oscillator 1350-2350MHz
Low Pass Filter
Prescaler
ATA
4x10dB RF-Attenuator
Audio AMP. + 6V DC
XYF
Y Final Amplifier
Y - GAIN
Y - POS.
X Final Amplifier
X - GAIN
X - POS.
Video Filter
CRT
HV & Blanking
PS
Power Supply
MB
Sawtooth Generator
Marker
MK
Tuning Voltage Generator
CF
Scanwidth Switch
LED Display Control
Clock Generator
TG
HM5011 only
4x10dB RF – Attenuator
Level Detector
LEVEL
Amplifier
Amplifier
PIN Control
256:1
Low Pass Filter
PLL
Mixer
Voltage Controlled Oscillator
Amplifier
LED-Display
Step. Gen. Scanwidth

HAMEG® Instruments

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Multimeters

Counters

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